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WIDEBAND TRANSMISSION TEST SET

OPERATION MANUAL

INSTRUMENT REPAIR SERVICE, INC
3135 REPS MILLER RD.
NORCROSS, GA 30071

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INSTRUMENT REPAIR SERVICE, INC.
3135 JEFFS MILLER RD.
NORCROSS, GA 30071

SECTION 1
GENERAL

1.1 INTRODUCTION

1.1.1 This manual supplies the information required to operate the Sierra 812A Wideband Transmission Test Set. This section provides a general description of the set and an overview of its applications.

1.1.2 Subsequent sections describe in detail the operating controls and indicators, provide a functional description with block diagrams, discuss operating procedures, supply maintenance instructions, and present technical data. The final section is an appendix which includes default values, error numbers, and readouts for selected functions.

1.2 GENERAL DESCRIPTION

1.2.1 The 812A is a microprocessor-based test set which measures the following analog line parameters that affect data transmission:

- Circuit loss and frequency response
- Attenuation distortion
- Noise
- Noise-with tone
- Signal/noise
- Noise/ground
- Impulse noise
- Peak-to-average ratio
- Return loss measurements over two-wire/four-wire segments

1.2.2 Key elements of this compact unit are a microprocessor with a pressure-sensitive membrane keyboard, and an LCD alphanumeric display. The 812A has three sets of keypads– FUNCTION, DISPLAY, and ENTRY; it also has configuration pushbutton controls. Nine FUNCTION keys allow an operator to select the appropriate transmit and receive circuits for a particular test. Each measurement mode is coordinated with its respective key.

1.2.3 These nine basic functions can then be modified, as necessary, by using the ENTRY keys. The ENTRY keypad is also used to enter numeric data, such as Level and other selectable test variables.

1.2.4 Test variables are normally selected before the test begins, and are entered in a specific sequence. FUNCTION, DISPLAY, and ENTRY keys have associated LED indicators, which illuminate when the corresponding key is depressed. The flashing of an LED associated with one of these keys, or of a number in the display, prompts the operator to make the next selection. Once the ENTER key has been pressed, the LED stops flashing.

1.2.5 The 812A possesses these operations capabilities:

- An extended frequency range (50 Hz to 85 kHz) is provided.
- Attenuation distortion may be measured using any frequency as the reference.
- Five types of noise measurements can be made: C-message noise, 3 kHz flat noise, 15 kHz flat noise, 50 Kb/s flat noise, or program weighting format noise.
- The impulse count can be measured at three distinct levels for a selectable period of time, and at either a standard (8 PPS) or a channel-limited (100 PPS) rate.

Options:

- The P/AR function allows an operator to make the standard P/AR measurement required for line turn-up and maintenance in the Bell System.
- Return Loss (two-wire and four-wire) is measured for Echo Return, Singing Return, and Singing Return High cases.

1.2.6 The 812A is designed for use on telephone lines. It can be an invaluable aid to data installation groups and VF test personnel.

SECTION 2

PHYSICAL DESCRIPTION

2.1 GENERAL

2.1.1 This section provides a physical description of the test set, identifies the controls on the front panel, and describes their functions.

2.1.2 The 812A Wideband Transmission Test Set is a portable instrument in an aluminum housing. It weighs 22 pounds, including batteries. When the set is used in a horizontal position, the carrying handle can be used as a stand.

2.1.3 The LCD displays, the operating controls (including keypads and pushbuttons), the POWER switch, and the DIAL/RCV/TRMT jacks are all conveniently located on the front panel of the test set. The Voltage Selection switch, an AC line fuse, and the input connector are all located on the rear of the instrument.

2.2 ACCESSORIES

2.2.1 The test set is equipped with a standard power connector/fuse/switch assembly and a removable power cord. Options available are the SOF-PAK carrying case (with a large accessories compartment) and a shipping trunk.

2.3 CONTROLS AND INDICATORS

2.3.1 Operating controls described in this section are listed in the following index:

ITEM	DESCRIPTION	PAGE
1	FUNCTION Keys	2-2
2	DISPLAY Keys	2-6
3	ENTRY Keys	2-7
4	Configuration Pushbuttons	2-9
5	Digital Display	2-11
6	Rear Panel	2-12
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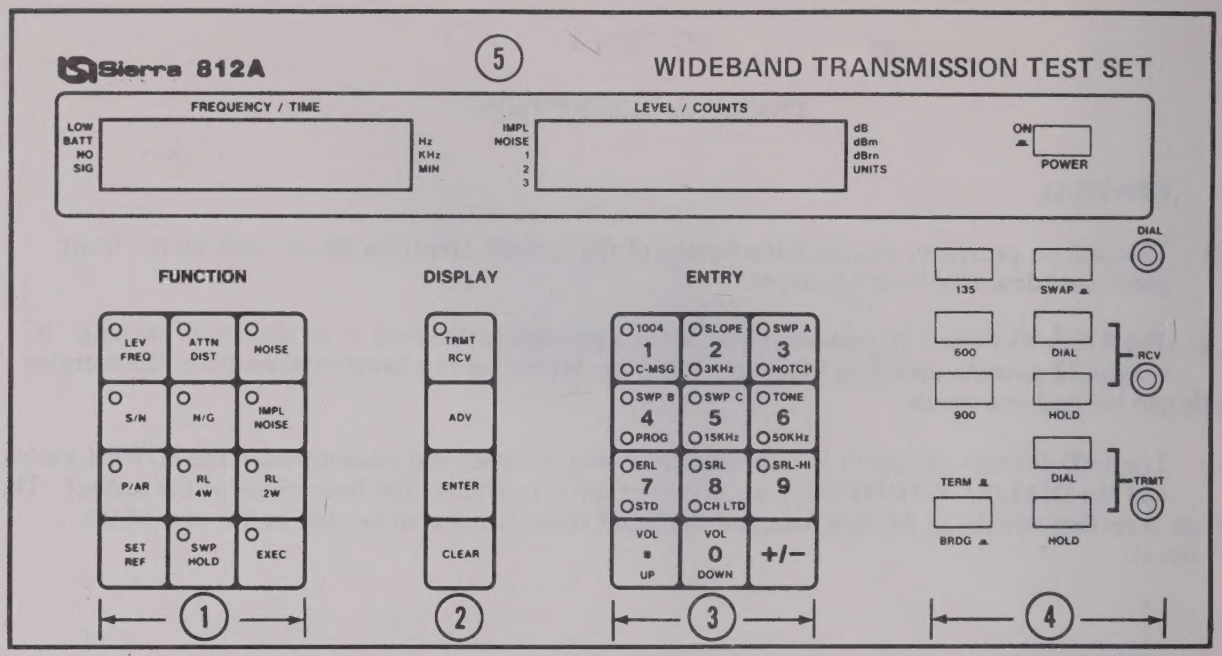
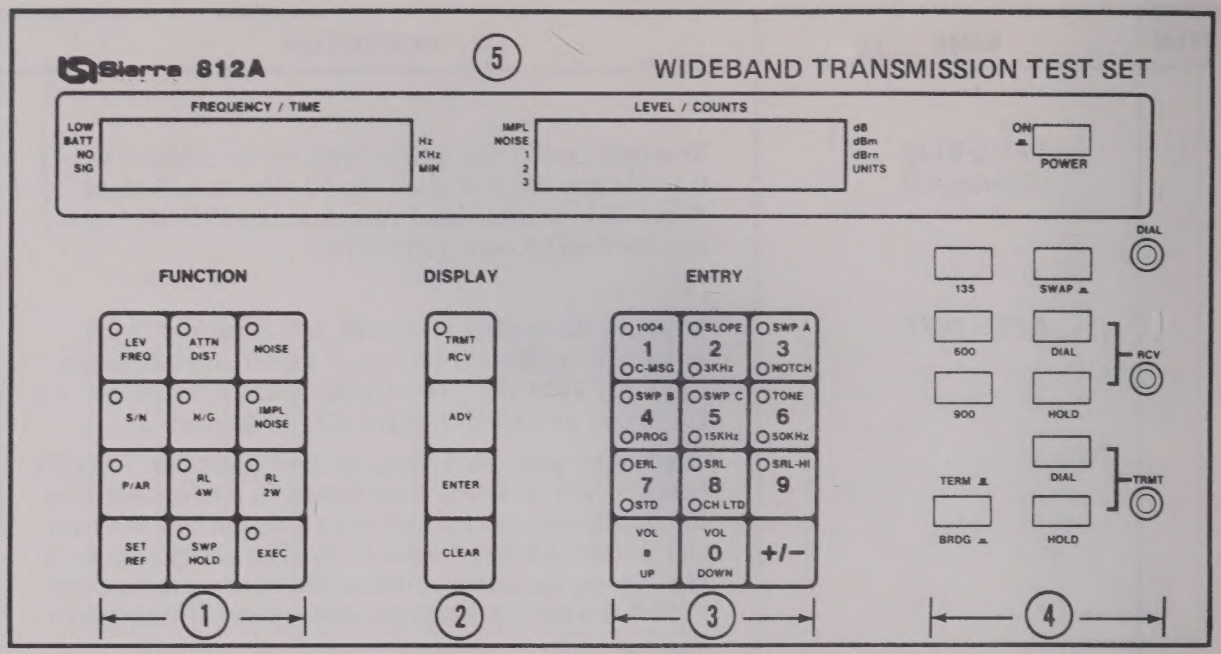


Figure 2-1. Front Panel Showing Numbered Items

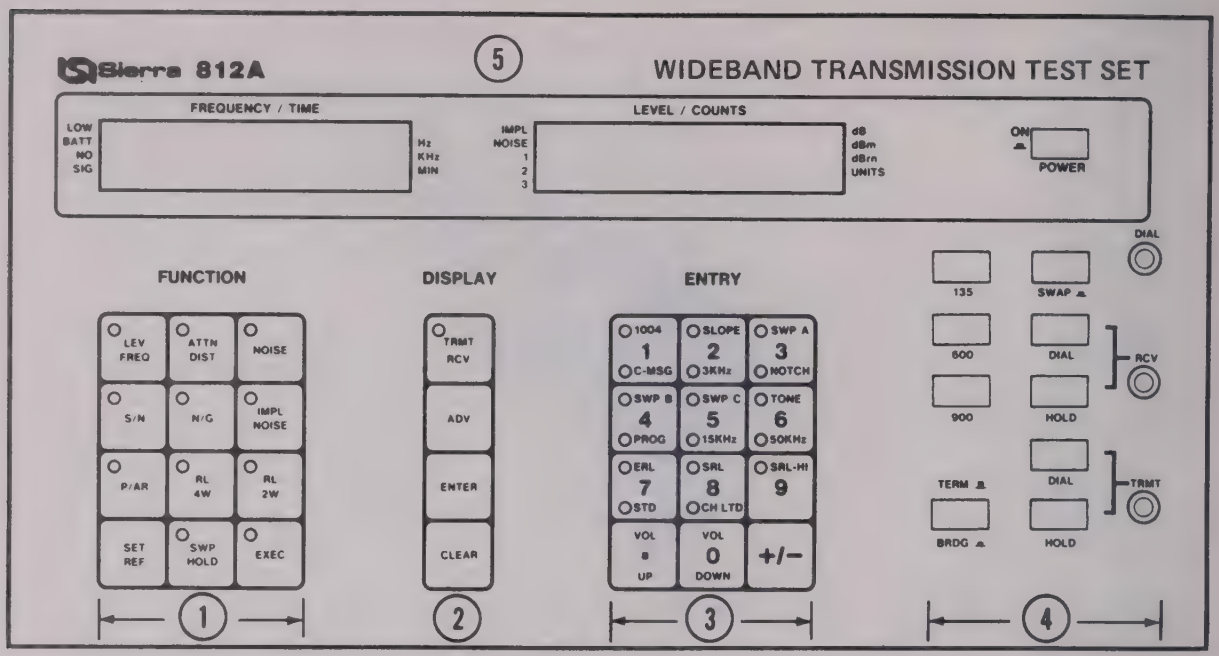
ITEM	NAME	DESCRIPTION
1	FUNCTION Keys	Select the test function of the instrument. Nine keys in the first three rows are directly related to the different types of tests. Each of the three colored keys performs a specific function during a test. When a function key is selected, the LED associated with it lights steadily. This indicates to the user that the test associated with the lit LED is current, and that further keypad entries will pertain to that test until another function key is pressed. Once a function key is pressed, the user is prompted for entry of parameters applicable to the test function via Digital Display (see Item 5) and flashing LED on Entry keypad (see Item 3). By operating any one of the remaining eight function keys while a selected test function is current or in progress, the test is immediately aborted.
	LEV/FREQ	Selects a tone source for transmit and the full-wave average levelmeter for receive. **Transmit Frequency**: The test set provides a choice of six functions—1004 Hz test tone, SLOPE tones, Sweep A, Sweep B, Sweep C, or a discrete tone frequency. The sweep frequency plans allow a preprogrammed series of tones to be transmitted at 5 second intervals, unless manually overridden with the SWP HOLD key. Frequency Range: 50 Hz to 85 kHz.

ITEM	NAME	DESCRIPTION
1	LEV/FREQ (Continued)	**Transmit Level:** The output level can be adjusted in 0.1 dB steps within a range of -50 dBm to +10 dBm. Select and enter the level using numeric ENTRY keys and the ENTER key, respectively.
	ATTN DIST	Measures the relative level, with loss displayed as the difference in dB from the loss at a reference frequency (typically 1004 Hz). The display reads Attenuation Distortion or a relative loss in dB (direct reading). The test set provides a choice of four functions – SLOPE tones, Sweep A, Sweep B, or Sweep C. The output level can be selected and entered using numeric ENTRY keys and the ENTER key, respectively. The sweep frequency plan allows a preprogrammed series of tones to be transmitted at 5 second intervals, unless manually overridden. The test starts with 1004 Hz to set the reference, but a frequency other than 1004 Hz can be selected as a reference using the SET REF key.
	NOISE	Measures circuit noise and noise-with-tone in a listening mode. Selects a filter and an RMS meter for receive and quiet termination for transmit. The test set provides a choice of five noise filters–C-MSG, 3 kHz, PROG, 15 kHz, or 50 kb/s. The noise measurement can be done with or without a NOTCH filter. The display reads the noise level in dBrn (direct reading).
	S/N	The S/N Function automatically selects a NOTCH filter, in combination with the selected filter for receive and the 1004 Hz tone for transmit. This measurement selects the levelmeter prior to passing through the NOTCH filter, and also connects the noise meter after passing through the NOTCH filter. The difference between the two values is automatically calculated and the result is displayed as a direct value of S/N ratio in dB. The display can be stepped, using the ADVANCE key, to read first a notched noise in dBrn, then the frequency (1004 Hz) and level of the tone. Measures noise-with-tone in a non-listening mode.
	N/G	Selects a quiet termination for the transmitter, and measures common mode noise-to-ground weighted by the selected filter. The result is displayed in dBrn.



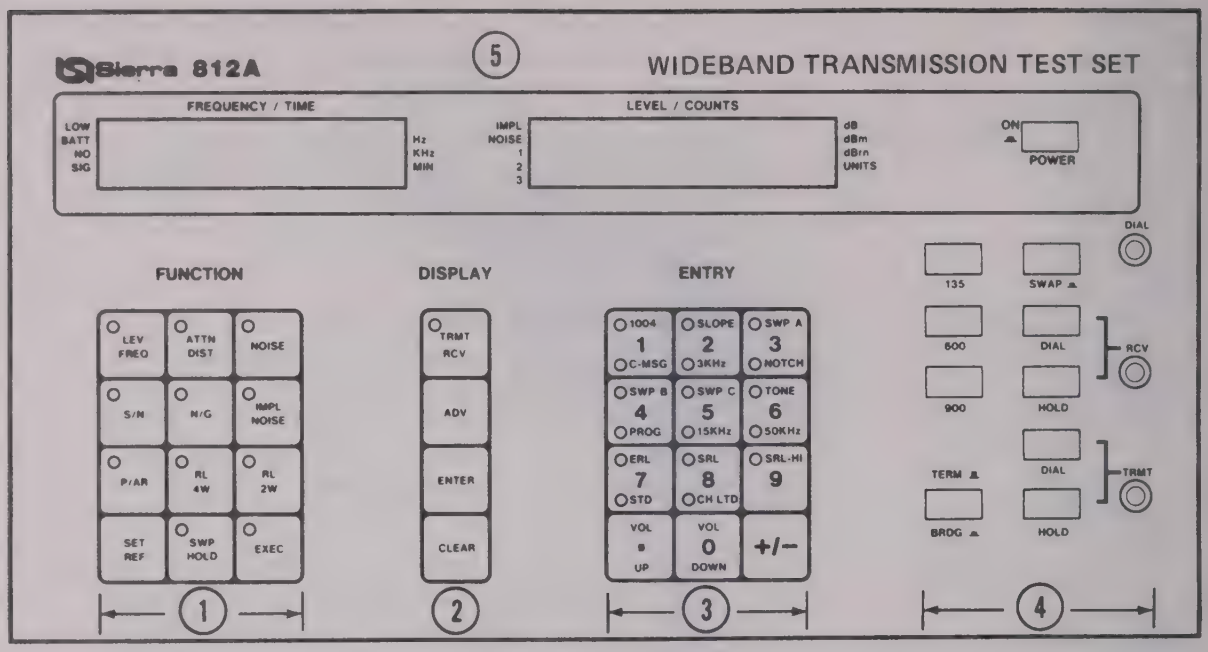
ITEM	NAME	DESCRIPTION
1	IMPL NOISE	Selects a 1004 Hz test tone for the transmitter, and the notch filter in the receiver, then counts noise impulses for a selected time interval. Impulse Noise counts are taken at three levels: The Lowest (Level No. 1) is at threshold; Mid (Level No. 2) is preset at +4 dB above the threshold; and High (Level No. 3) is preset at +8 dB above the threshold. This function includes selection of Transmit Level, Noise Filter, Threshold Level, Count Rate, and Count Time. Transmit Level: −50 dBm to +10 dBm range Noise Filter: C-MSG, 3 kHz, PROG, 15 kHz, 50 kb/s Threshold Level: −30 dBrn to 110 dBrn range Count Rate: Standard (8 pps) or Channel-limited (100 pps) Count Time: 1 through 9999 minutes, or continuous count (count time set to 0 minutes).
	P/AR	The Peak-to-Average Ratio measurement selects a special transmit signal composed of 16 non-harmonically related sine waves and a P/AR receive filter. This is a figure-of-merit test, which is primarily influenced by attenuation distortion, envelope delay distortion, and noise. It is most useful as an indication of channel degradation based upon comparisons with previous P/AR measurements over a period of time.

ITEM	NAME	DESCRIPTION
1	RL 4W	The 4-Wire Return Loss function transmits a shaped noise test signal and measures a **received signal level**. The test signal is obtained by passing a wideband noise source through a bandpass filter. A choice of three transmit filters is available: Echo Return Loss (ERL), Singing Return Loss (SRL), and Singing Return Loss High (SRL-HI). The measurement is made by transmitting band-limited noise of known power, and measuring the energy reflected back to the **receiver**. On a 4-wire circuit Return Loss is the power ratio—transmitted power to reflected power—corrected for any difference in the expected transmission levels (TLPs) of the sending and receiving sides. This measurement requires a quiet termination at the distant end of the circuit.
	RL 2W	The 2-Wire Return Loss function transmits a shaped noise test signal and measures the **reflected signal level**. An internal hybrid in the test set is used for this measurement. The test signal is obtained by passing a wideband noise source through a bandpass filter. A choice of three transmit filters is available. They are Echo Return Loss (ERL), Singing Return Loss (SRL), and Singing Return Loss High (SRL-HI). The measurement is made by transmitting band-limited noise of known power and measuring the energy reflected back to the **transmitter**. The Return Loss is the ratio of the transmitted power to the reflected power. Return Loss measurements require a quiet termination at the distant end of the circuit.
	SET REF	The Set Reference function is used as follows: (1) During the **Attenuation Distortion** test to select a frequency other than 1004 Hz, at which the reference level is established. If the SET REF Key is not used, 1004 Hz will be the default reference frequency. (2) During the 4-Wire Return Loss measurement, the transmission loss (transhybrid loss plus circuit loss) in the loop is determined by putting a short at the 2-wire side of the hybrid. Pressing the SET REF key sets that determined value as a reference to be used with future Return Loss readings. Return the hybrid to normal operating mode to read the Return Loss in dB.



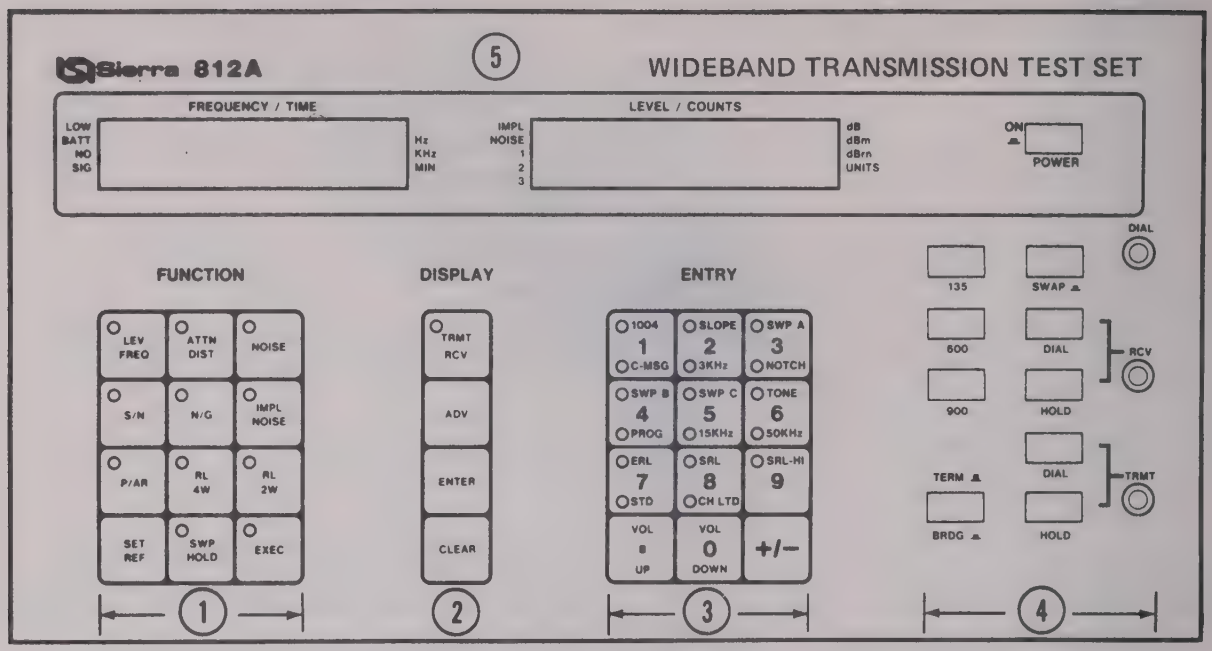
ITEM	NAME	DESCRIPTION
1	SET REF (Continued)	(3) During an Impulse Noise measurement, pressing the SET REF key starts the test. The counting begins and the display reads the level #1 threshold count.
	SWP HOLD	This is a dual function key. The SWP HOLD key can be used to start or stop the sweep at any frequency in the sweep plan. When first pressed after a pause in a sweep, it starts the sweep. Next use will stop the sweep. Pressing the key again restarts the sweep.
	EXEC	Completes the selection process for a test, and executes the test function according to the selected parameters.
2	**DISPLAY Keys**	The operation of any one key in this group determines the information in the display windows. The CLEAR and ENTER keys are operational only in FUNCTION ENTRY Mode.

ITEM	NAME	DESCRIPTION
2	TRMT/RCV	This is a dual function key. It switches the display between transmit and receive information. The associated LED shows whether TRMT is selected. Press the TRMT/RCV key to change the displayed information.
	ADV	The ADVANCE key is used as follows: 1. In S/N test, three displays can be selected: Signal-to-Noise ratio in dB; Noise in dBrn; Tone frequency plus the received level. 2. In Impulse Noise test, it selects which of the three threshold counters is displayed.
	ENTER	Completes the selection process at an entry level. Pressing the key tells the instrument to remember the currently selected value, and to use this value when executing the test. Invalid entry, such as an out-of-range numeric entry, generates an error message. The instrument reverts to the previously selected parameter.
	CLEAR	Cancels a selection or a partial entry. It is used to correct an entry before that value is being entered, erasing one digit at a time. It is also used to remove the notch filter in the noise measurement. *Note: It can not be used to change a selection after the ENTER key is operated.*
3	**ENTRY Keys**	This is a standard keypad used to enter numeric values. ENTRY keys choose conditions for all tests. Each key has triple functions and the functions are as noted on the key. The primary function is to enter numbers 1 through 9, zero and ±. The secondary functions vary with the keys. LEDs are associated with each secondary function. Flashing LED shows the prompted selection request. Once the ENTER key is operated, the LED stops flashing to indicate an active test selection. When pressed during a frequency sweep, the +/– key causes the output frequency to sweep backwards one step for each push. SECONDARY FUNCTIONS **Six Transmit Frequency Plans Used for LEV/FREQ and ATTN DIST Measurement**
	1004	A 1004 Hz tone is transmitted.



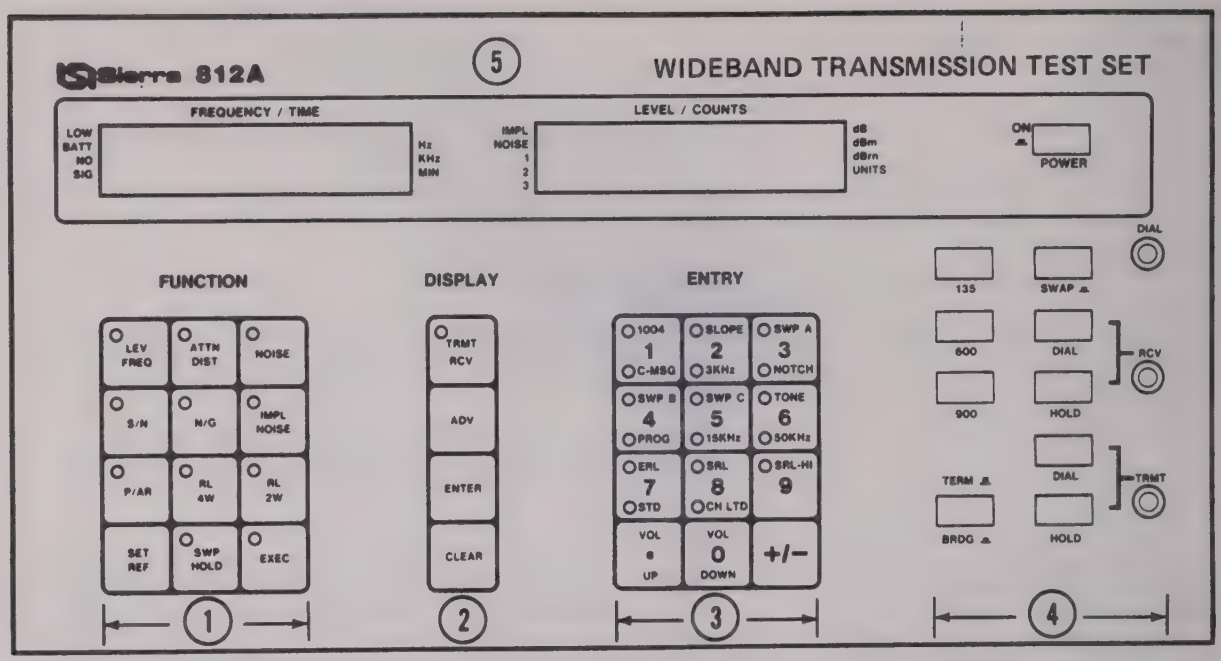
ITEM	NAME	DESCRIPTION
3	SLOPE	Provides Slope tones – 404 Hz, 1004 Hz, and 2804 Hz. This frequency plan is preceded by 1004 Hz tone.
	SWP A	Provides a Standard Sweep covering the frequency range between 304 Hz and 3204 Hz. The frequency is stepped 17 times at five second intervals. The frequencies in the sweep are 304 Hz, 504 Hz, 604 Hz, 804 Hz, 1004 Hz, 1204 Hz, 1404 Hz, 1604 Hz, 1804 Hz, 2004 Hz, 2204 Hz, 2404 Hz, 2504 Hz, 2704 Hz, 2804 Hz, 3004 Hz, and 3204 Hz. This frequency plan is preceded by a 1004 Hz tone.
	SWP B	Provides a sweep covering the range between 204 Hz and 4004 Hz in 100 Hz steps (excluding 2604 Hz) at five second intervals. This frequency plan is preceded by a 1004 Hz tone.
	SWP C	Provides a programmable sweep. START frequency, STOP frequency, STEP size, and SKIP frequency are sequentially entered using numeric entries.
	TONE	Provides a tone at a selected frequency. The tone is selected using numeric entries.
		Six Noise Weighting Filters Used for NOISE, S/N, N/G, and IMPULSE NOISE Measurement
	C-MSG	C-Message Filter approximates frequency weighting of a telephone handset. The response is approximately flat across the center of the band (600-3000 Hz).

ITEM	NAME	DESCRIPTION
3	3 kHz	A 3 kHz bandpass flat filter. It includes more low frequency and high frequency signals than does C-MSG.
	NOTCH	A notch filter centered at 1010 Hz. It eliminates holding tone in the range from 995 Hz to 1025 Hz, and is used for Noise-with-Tone measurements.
	PROG	A program weighting filter for noise measurements on a program channel.
	15 kHz	A 15 kHz flat filter for wider bandwidth noise measurements on program circuits (not used on voice message circuits).
	50 kHz	A 50 kHz flat filter for noise measurement on a DDS circuit.
		Transmit Filters Used for Return Loss Measurements
	ERL	Echo Return Loss filter. Weighting: 560 Hz to 1965 Hz (3 dB points).
	SRL	Singing Return Loss filter. Weighting: 260 Hz to 500 Hz (3 dB points).
	SRL-HI	Singing Return Loss-High filter. Weighting: 2200 Hz to 3400 Hz (3 dB points).
		Count Rate Used for Impulse Noise Measurements
	STD	Selects a standard count rate (8 pps, having a blanking interval of 125 ms after each count).
	CH LTD	Selects a channel-limited count rate (100 pps, having a blanking interval of 10 ms after each count).
		Speaker Volume Adjustment Keys
	VOL UP/ VOL DOWN	These keys are active in Measure mode. Pressing either key adjusts the volume of the speaker up or down in steps.
4	**Configuration Pushbuttons**	These pushbuttons control how the instrument is connected to the circuit. All pushbuttons operate as ON/OFF switches. Button released (normal position) is an 'OFF' state. Button pushed in is an 'ON' state.
		Selection of Impedance Values of TRMT and RCV
	135 600 900	Selects 135 ohms as an input and output impedance Selects 600 ohms as an input and output impedance Selects 900 ohms as an input and output impedance



ITEM	NAME	DESCRIPTION
4	TERM/BRDG	Selects terminated or bridging condition for Receiver. When the button is released the receiver is terminated. When the button is pushed in the receiver is bridged (> 50 k ohms).
	SWAP	Switches the Transmit and Receive ports and their associated hold circuitry.
	RCV DIAL and TRMT DIAL	A separate dial facility for Receive and Transmit ports permits a test line to be dialed up by means of an external telephone handset connected to the Dial jack. When the button is released the Dial terminals are disconnected. When the button is pushed in the Dial terminals are connected to appropriate jack (RCV or TRMT).
	RCV HOLD and TRMT HOLD	Two separate active holding circuits for Receive and Transmit draw holding current via a selected port. When the button is released the holding circuit is disconnected. When the button is pushed in, the holding circuit is connected to the circuit on the port.

ITEM	NAME	DESCRIPTION
4	DIAL Terminal	Standard 310-type jack used for connecting dial set.
	RCV Terminal and TRMT Terminal	Standard 310-type jacks used for connection to lines.
	Power Switch	Red pushbutton
	ON ▬	When button is released, the instrument is in standby and the batteries (optional) are charging, if connected to an AC supply. When button in pushed in, power is supplied to the measurement circuitry and the batteries are not charging.
5	**DIGITAL DISPLAY**	Consists of seven-segment LCD displays. Frequency/Time is displayed in the left window and Level/Counts/Units displayed in the right window. The display is switchable from TRMT to RCV using the TRMT/RCV key. In addition to the numeric values, the display has twelve bar displays. These displays provide status information on the instrument, and show the units of displayed information.
	LOW BATT	Lights when internal batteries are at a low level.
	NO SIG	Flashes during timed Impulse Noise test when the 1004 Hz tone is lost, i.e., no signal is received. This will be displayed when the 1004 Hz tone drops by at least 12 dB from the original level for one second, or when the frequency is outside the range from 995 Hz to 1025 Hz. This condition will stop an Impulse Noise test since the results are invalid. Also flashes during P/AR test when no input signal is present.
	Hz/kHz	Lights to indicate whether the received frequency is in Hertz or kiloHertz.
	MIN	Lights during Impulse Noise test. It shows time selected for test, time left, or time elapsed depending on test selected.
	IMP NOISE	IMP NOISE flashes while Impulse Noise test is running.
	1, 2, 3	Impulse Noise Level 1, 2, and 3 lights to show which Impulse Noise counter is currently being displayed (No. 1 is LOW, No. 2 is MID, No. 3 is HIGH).



ITEM	NAME	DESCRIPTION
5	dB	Lights when the display reads the relative strength (power) of a signal parameter. Unit: decibel.
	dBm	Lights when the display reads an absolute power referenced to 1 milliwatt.
	dBrn	Lights when the display reads decibels above reference noise. Reference noise is equivalent to –90 dBm signal.
	UNITS	Lights when the display reads P/AR units or counts in Impulse Noise.
6	**Rear Panel**	
	AC Power	Fused 115/230 VAC Connector. Voltage selection (115/230V) available on the plug-in card. Slow Blow Fuse: 3/8A for 115V and 3/16A for 230V.
7	**Internal**	
	Speaker	Provides a facility for audio monitoring of the Receiver with a step volume control.
	Backup Battery	Provides a backup to remember the test parameters when the unit is turned 'OFF'. It provides backup for a minimum of 2 weeks.

SECTION 3

FUNCTIONAL DESCRIPTION

3.1 GENERAL

3.1.1 The Sierra 812A Wideband Transmission Test Set is a full-duplex transmission measurement system controlled by a microprocessor; Figure 3-1 provides a functional block diagram of this system. Microprocessor interfaces to the various sections of the 812A are described in Figure 3-2, while Figure 3-3 depicts the 812A's AC and DC (optional battery pack) power supply circuits.

3.2 LINE INTERFACE

3.2.1 The TRMT and RCV lines each have a DIAL and HOLD interface. Further, the TRMT, RCV, and DIAL lines all use 310-type jacks. High voltage protection is also provided to prevent damage to the test set caused by lightning-induced voltage surges.

3.2.2 All standard impedances (900, 600, and 135 ohms) are provided, and the set may be placed in either a bridged or a terminated mode through the appropriate use of the TERM/BRDG switch. When operating in the terminated mode, either a 135, 600, or 900 ohm termination may be selected as appropriate for the line under test. The bridging mode permits measurements to be performed on a working circuit, or on circuits which are already terminated; high impedance (greater than 50 k ohms) is presented to the circuit under test, resulting in a bridging loss of 0.25 dB or less.

The DIAL port allows an external telephone handset to be connected. In the DIAL mode, either the transmit or receive direction of the line under test can be dialed-up. The HOLD switch draws a holding current for the associated TRMT or RCV port. The SWAP switch allows the transmit and receive lines to be interchanged between ports.

3.3 SELF TEST

3.3.1 Each time the 812A is turned on, a complete self test is performed automatically. During this test, the transmitter test tone is routed internally to the receiver input to provide a check of the Receiver Front End and Amplifier Stages, Detectors, and the Frequency Counter, as well as of the Attenuator and Output Driver for the Transmitter section. Any option boards present are also tested. The self test also allows the user to check the 812A display.

3.4 TRANSMITTER

3.4.1 As shown in Figure 3-1, the transmit section consists of a signal source and a level control. The standard signal source is a sinewave synthesizer. A P/AR waveform generator, and a wideband noise generator for return loss measurements, are both available as options. If either or both of these options are chosen, the appropriate source is selected by depressing the FUNCTION key. The desired signal is then routed through the analog multiplexer and the level control to the line terminating circuitry.

3.4.2 The sinewave synthesizer generates single frequencies in 1 Hz steps over the 50 Hz to 85 kHz range. Signal level is also variable over a range of -50 dBm to +10 dBm in 0.1 dB steps (the optional P/AR and Return Loss functions have a 0 dBm maximum output). Both signal frequency and level can be selected by using the numeric ENTRY keys.

3.4.3 The sinewave synthesizer also provides the SLOPE test tones, two VF sweep plans (SWP A and SWP B), and a programmable sweep (SWP C). In the SWP A and SWP B modes, the synthesizer is programmed to blank the 2600 Hz SF tone. This prevents the loss of the VF channel connection on dial-up trunks using SF signaling units.

3.4.4 The transmitter is controlled by the EXECUTE and SWP HOLD keys. When the 812A enters the FUNCTION ENTRY mode, the transmitter is automatically turned off. The transmitter can only be turned on again by entering the TEST mode using the EXECUTE key.

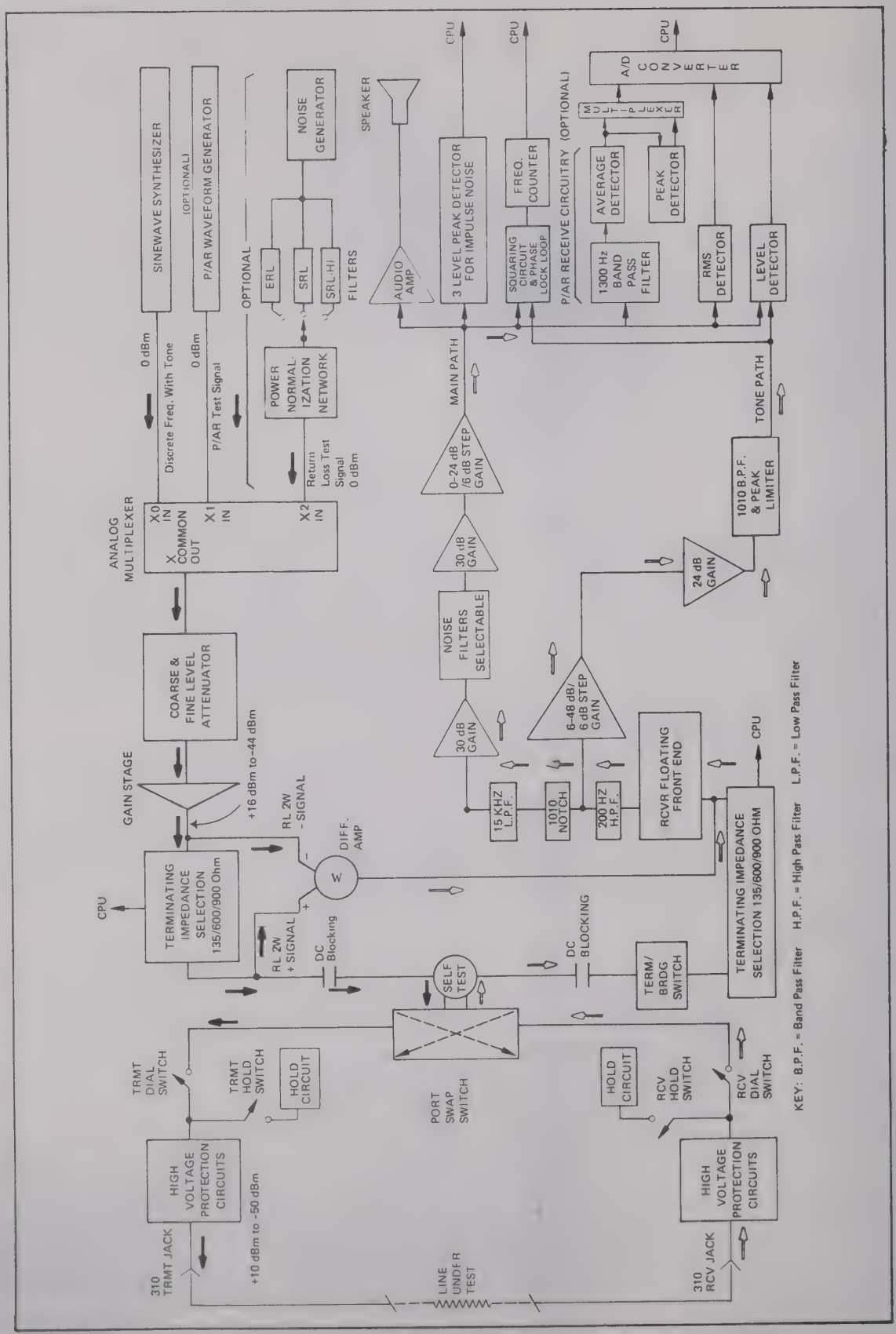


Figure 3-1. Functional Block Diagram Showing Signal Path

3.4.5 OPTIONAL TRANSMIT SIGNALS

(1) **P/AR Waveform Generator:** A special transmit signal composed of sixteen non-harmonically related sine waves is produced by the P/AR waveform generator. This waveform is passed through a special low pass filter prior to reaching the analog multiplexer.

(2) **Return Loss Test Signal:** The output of a wideband noise generator is passed through one of three types of transmit filters. Depending upon the type of return loss measurement selected, either an Echo Return Loss (560 Hz to 1965 Hz), Singing Return Loss (260 Hz to 500 Hz), or Singing Return Loss-High (2200 Hz to 3400 Hz) transmit filter is selected. The power normalization network normalizes the Return Loss test signal to 0 dBm.

3.5 RECEIVER

3.5.1 The signal received from the line under test is fed into the receiver front end; the receiver front end is isolated from power supply ground, and floats on the common mode voltage at the receive side of the line under test (see Figure 3-1).

After leaving the receiver front end, the received signal is routed along one of two possible paths (main or tone), and is filtered and/or amplified as appropriate for the test in progress. Filters available are a 200 Hz high pass filter, a 1010 Hz notch filter (noise measurements can be made with or without the notch), a 15 kHz low pass filter, and the noise filters. Similarly, a 1010 Hz bandpass filter in the tone path filters and limits the received signal for holding tone measurements. The function selected determines which filter(s) is used.

3.5.2 Once the signal has been amplified and/or filtered, it is routed to the detector stage. As shown in Figure 3-1, the basic elements of this stage are:

(1) **Audio Output Section:** This consists of an audio amplifier and speaker for monitoring the received signal. Speaker volume is adjustable up or down in steps by using the appropriate ENTRY keys.

(2) **3-Level Peak Detector:** Impulse Noise measurements are made at three levels, the first level being a selected threshold. Levels 2 and 3 are predefined at 4 dB and 8 dB, respectively, above the threshold. Each level has a separate counter.

(3) **Squaring Circuit and Phase Lock Loop:** The squaring circuit converts a sine wave to a square wave; the output from the phase lock loop is applied to the frequency counter, which reads the frequency of the received analog signal and conveys this data digitally to the CPU.

(4) **Full-Wave Average and RMS Detectors:** The received signal tone is detected and measured by the averaging level detector; the noise level is detected and measured by the true RMS detector. Detector outputs are then applied to an analog-to-digital converter, whose digital output is conveyed to the CPU via the data bus.

3.5.3 OPTIONAL STAGES: The function of the optional P/AR and return loss measurement circuitry is described in the following sub-paragraphs:

(1) **P/AR Signal Measurement Option:** As shown in Figure 3-1, the P/AR signal is routed to the detection stage via the main path. The signal is then passed through a 1300 Hz bandpass filter, an average detector, and a peak detector. The peak and average detected outputs are then transferred to a multiplexing stage and fed into an A/D converter. A/D converter output is routed to the CPU, where the P/AR is computed.

(2) **Return Loss Signal Measurement Option:** Return loss measurements may be performed on two-wire or four-wire circuits. The 2W or 4W Return Loss signal is detected and measured by the RMS detector; it is then expressed as the ratio of the transmitted power to the reflected power. In a two-wire

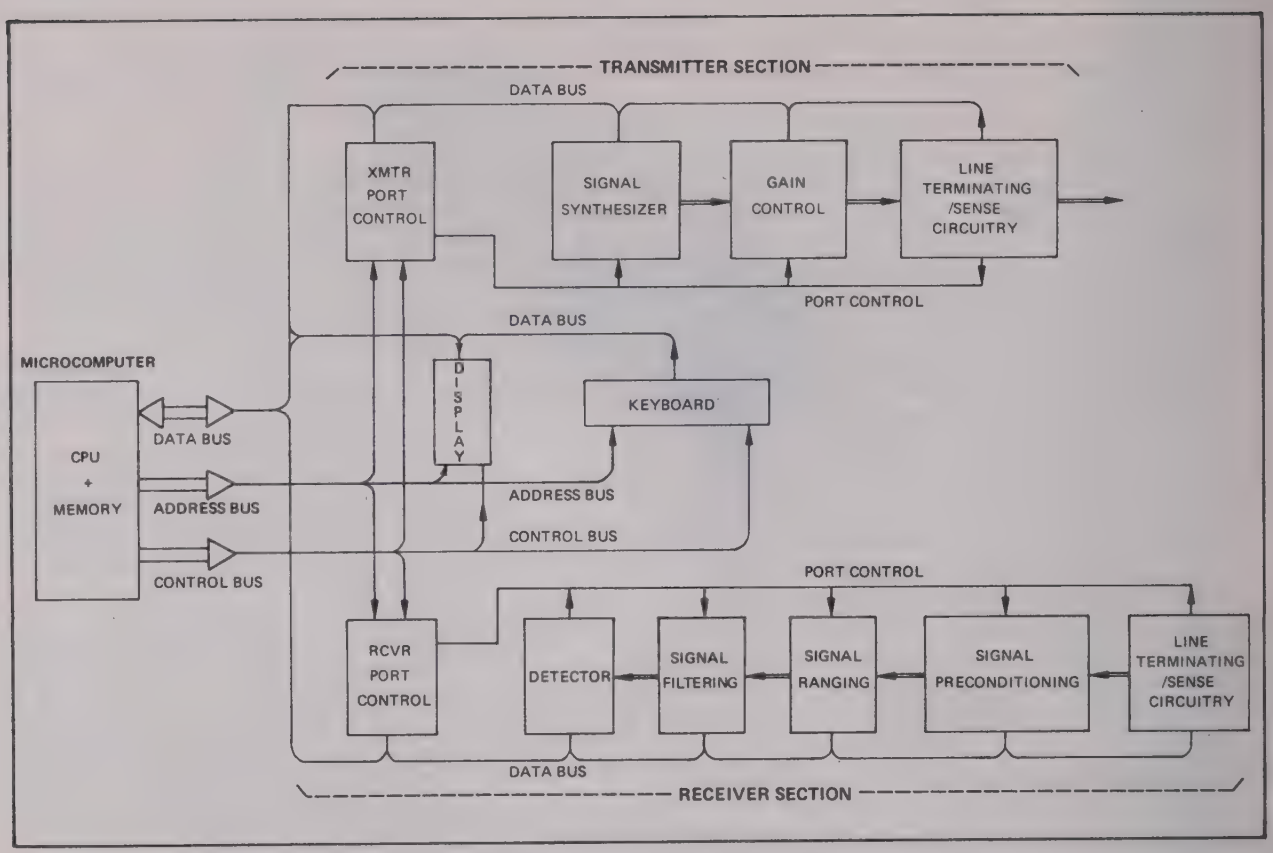


Figure 3-2. Interface Connections

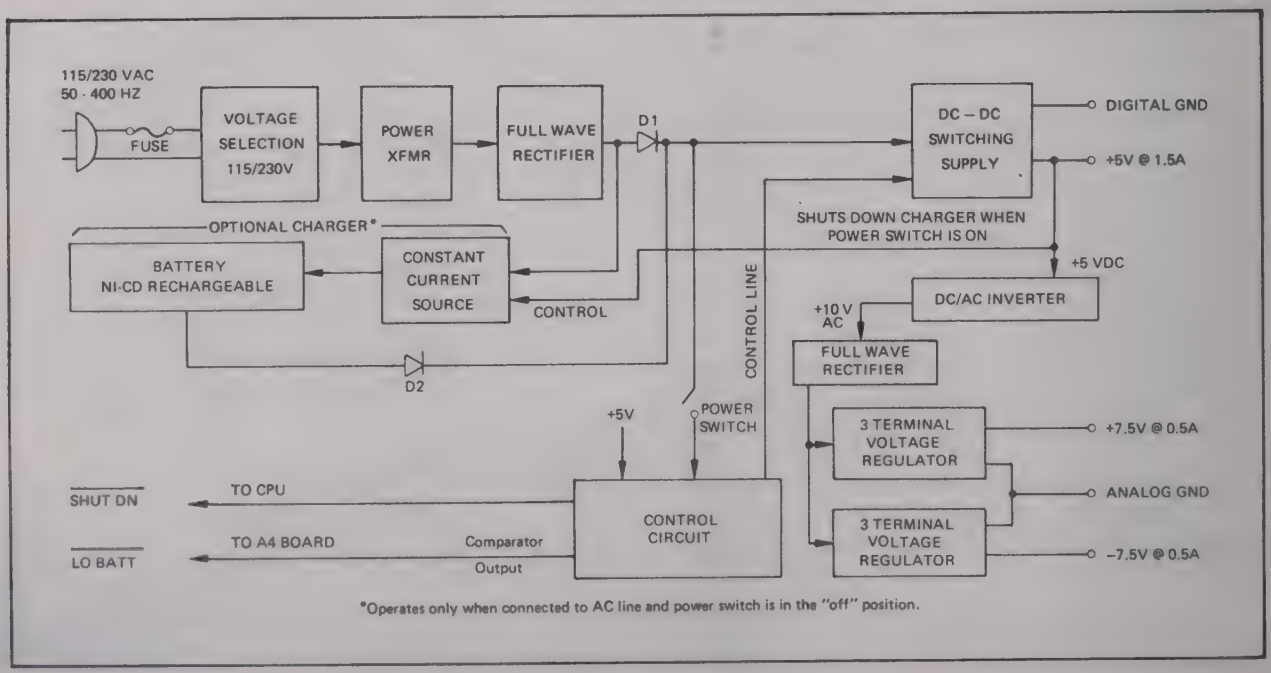


Figure 3-3. 812A Power Supply Circuits

circuit, energy is reflected back to the transmitter; in a four-wire circuit, energy is reflected back toward the receive side of the line.

As Figure 3-1 shows, the RL 2W+ signal is applied to the differential amplifier simultaneously with the RL 2W- signal.

3.6 MICROCOMPUTER

3.6.1 The microcomputer controls all the major functions of the test set, including the Transmitter, Receiver, Keyboard, and Display. It interfaces with these major functional sections via the data and address buses (as well as via a control bus in the case of the Keyboard), as can be seen in Figure 3-2. The microcomputer itself consists of the Central Processing Unit (CPU) and two types of memory: (1) a Programmable Read-Only Memory (PROM) and a Random Access Memory (RAM).

3.7 DISPLAY

3.7.1 The 812A has two separate displays for FREQ/TIME and LEVEL/COUNTS indications; each display window contains four seven-segment liquid crystal displays (LCDs). In addition, 12 LCD bar displays provide instrument status information.

The display is switched automatically from "transmit" to "receive" as required to show measured values. Transmit parameters can be checked by manually operating the TRMT/RCV Key.

3.8 POWER SUPPLY

3.8.1 The 812A can be powered by 115/230 VAC, or by an optional rechargeable battery pack. (Figure 3-3 provides a block diagram of these power supply circuits.) If the battery pack has been installed, the test set automatically switches over to battery operation whenever it is disconnected from the AC source.

3.8.2 For AC operation, a full-wave rectifier converts the 115/230 VAC, 50–60 Hz input to a basic 28 VDC supply. When the power switch is OFF and the unit is plugged in, the 812A enters a standby mode while the optional battery pack is being charged. Turning the power switch ON activates the DC-DC converter, which produces a +5 VDC output. Simultaneously, a control signal shuts down the battery charger (if installed). Further, the +5 VDC is also applied to the DC/AC inverter, whose output is then applied to a full-wave rectifier; the rectifier outputs both +7.5 VDC and –7.5 VDC.

3.8.3 The charger provides a constant current of 450 mA to the optional battery pack. It requires approximately 14 to 16 hours to bring the 14.4 V nickel-cadmium battery pack to full charge from a low charge state. A fully charged battery pack provides a minimum of four hours operation.

3.8.4 The control circuit (see Figure 3-3) generates signals on the LO BATT and SHUT DN lines, while the control circuit voltage comparator continuously checks the battery voltage. When battery voltage falls below 13.6 V, the LO BATT signal triggers the low battery indicator; the indicator flashes to indicate that battery power will only last another 10 to 20 minutes. When battery voltage reaches 12 V, the instrument shuts off. The SHUT DN signal prevents memory contents from being corrupted by transients created when the power switch is turned ON and OFF.

> *NOTE: If the test set is turned OFF during the low battery warning period, it will not reoperate on battery power without a recharge.*

3.8.5 The 812A test set also has a continuous battery backup designed to maintain the operating status in memory when the test set is turned off; this backup operates for a minimum of two weeks.

SECTION 4

OPERATING PROCEDURES

4.1 GENERAL INSTRUCTIONS

This section explains in detail how the 812A operates as a standard test set. The test set has two distinct operational modes: (1) FUNCTION ENTRY and (2) TEST.

Material in this section is arranged by functions. Each functional description provides detailed FUNCTION ENTRY and TEST instructions.

4.1.1 FUNCTION ENTRY MODE:

Individual test variables are selected in this mode: the test set is not measuring any values and the transmitter is 'OFF.'

The LEDs on the FUNCTION and ENTRY keypads prompt selection of new test parameters; a flashing display indicates the value of the parameter currently in memory. Test parameters are stored in memory only when the ENTER key is depressed.

The test set program controls the sequence in which parameters are selected. If parameter values do not change, the sequence can be advanced using the ENTER key.

The 812A assumes that all level values entered are positive(+). To change the sign of the displayed numeric value, the +/– key must be used. To correct an error, the CLEAR key is used.

QUICK REFERENCE INDEX

Page	Paragraph	Function
4-4	4.3	LEV/ FREQ
4-6	4.4	ATTN DISTORTION
4-8	4.5	NOISE
4-9	4.6	S/N
4-10	4.7	NOISE TO GROUND
4-11	4.8	IMPULSE NOISE
4-13	4.9	P/AR
4-13	4.10 & 4.11	RETURN LOSS 2W/4W

4.1.2 **TEST MODE:** Test mode is entered by pressing the EXECUTE key, thereby initiating the selected test functions. Both the transmitter and receiver are active in this mode; the display shows the values being measured. When a selected FUNCTION key is depressed again, or a new FUNCTION key is selected while the set is in TEST mode, the test in progress immediately stops.

The SWP HOLD and EXEC keys control both the transmitter and the receiver; the SET REF key controls the receiver alone.

NOTE: The VOL UP and VOL DOWN keys adjust speaker volume in 4 dB steps, and are only active in TEST mode.

4.2 INITIAL SETUP AND CONFIGURATION

4.2.1 **TURN ON PROCEDURE:** The 812A requires an operating voltage of 115/230 VAC (see Section 5), as indicated on the nameplate. Optional rechargeable batteries are also available.

Step 1: Connect power cord to receptacle on back of test set, and then to AC line source.

CAUTION

Voltage shown on plug-in card must match line source voltage. Failure to match voltages can result in serious damage to the test set.

Step 2: Push in the red button to switch on the power. The set will initialize itself and perform an automatic self-test.

During the self-test, if any internal problems are encountered, an error condition is returned; errors are displayed in the form: "EXX," where "XX" corresponds to the error numbers shown in Table 7-2. If the problems encountered are sufficiently extensive or serious, all "8s" and the software revision number are displayed; in such a case, the set cannot be used for further test procedures. If the problems encountered are sufficiently minor or localized, the set will be operable, but its performance may be degraded and errors may occur.

4.2.2 TEST SET CONFIGURATION

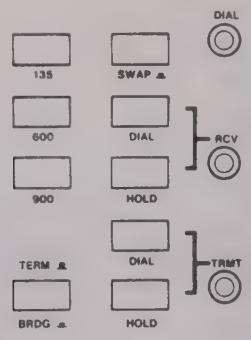


Figure 4-1. Configuration Controls

Step 1: Match the impedance of the set to the impedance of the circuit being tested. Normal impedance is 600 ohms; however, if 135 or 900 ohms impedance is required, press the appropriate pushbuttons.

Step 2: If the Receiver is to be used as a monitor, push the TERM/BRDG pushbutton in (BRIDGING). Normally, measurements are made in the TERMINATED mode, i.e., pushbutton out.

Step 3: Connect the circuit to the appropriate jacks on the front panel of the test set as follows:

a. Connect a four-wire circuit to the RCV and TRMT jacks.

b. Normally, connect a two-wire circuit to the RCV jack.

Step 4: The Port Swap facility applies to two-wire circuits only. Manually operate the SWAP button to interchange the Transmit and Receive ports.

4.2.3 DIAL-UP A CONNECTION

Proceed as follows:

Step 1: All the switches–DIAL, HOLD, and SWAP– should be released before connecting a circuit to the input jacks.

Step 2: a. Plug the telephone handset into the DIAL jack.

b. Plug the line to be tested into either the TRMT or the RCV jack.

Step 3: Push the associated DIAL switch to the ON position. The measurement circuits of the 812A are disconnected from the line, and the line is connected directly to the telephone handset. The telephone handset can now be used to establish a DDD connection, or if the connection has already been made, it can be used to communicate with the operator at the other test set. If the handset is being used for communication only, skip to Step 6.

Step 4: If the handset is being used to establish a DDD connection, dial the desired number with the handset.

Step 5: After a connection has been established, depress the appropriate HOLD switch; then release the DIAL switch. The holding current is maintained by the 812A's holding circuit, while the line is reconnected to the measurement circuitry.

Step 6: Now proceed with testing as described in the test procedure. If the Port Swap is to be used, make sure both HOLD switches are depressed and both DIAL switches are released; then press the SWAP switch. To release the line, release the HOLD switches.

TEST PROCEDURE

Each of the TEST functions is described in the following pages. Included are step-by-step instructions describing parameter selection and TEST mode procedures.

Whenever a key is pressed, the following three things occur:

1. The LED associated with the selected key lights steadily.
2. A key LED or a number in the display window flashes, prompting the operator to make the next selection.
3. The display conveys numeric information about parameters.

Test parameters must be entered into the test set in the prompted sequence. Depressing the CLEAR key prior to using the ENTER key will clear any numeric values; pressing a selected test's FUNCTION key again and restarting the test will clear any previously selected test parameters. For a prompted sequence which does not need to be changed, push the ENTER key and proceed to the next parameter.

4.3 LEVEL AND FREQUENCY

The LEV/FREQ function key is used for circuit loss and frequency response tests.

4.3.1 SET CONFIGURATION: The transmitter consists of a tone source (1004 Hz, selected frequency, or swept frequencies), while the receiver is configured as a "flat" levelmeter. A low frequency noise filter is inserted, which rolls off the response starting at 200 Hz, unless the measured frequency is below 400 Hz. When the measured frequency is below 400 Hz, no filter is used.

4.3.2 PARAMETER SELECTION: The level and frequency of the signal to be transmitted are selectable. The signal level is selectable within a range of -50 dBm to +10 dBm. The test signal can be a 1004 Hz test tone, a discrete tone frequency, SLOPE, or it can follow one of three frequency sweep plans: SWP A, SWP B, or SWP C. (All start at 1004 Hz, followed by the first frequency in the scan.) When using the programmable sweep (SWP C), Start Frequency, Stop Frequency, Step Size, and Skip Frequency are entered in sequence. To delete a Skip Frequency, enter zero.

The selection process is illustrated in Figure 4-2.

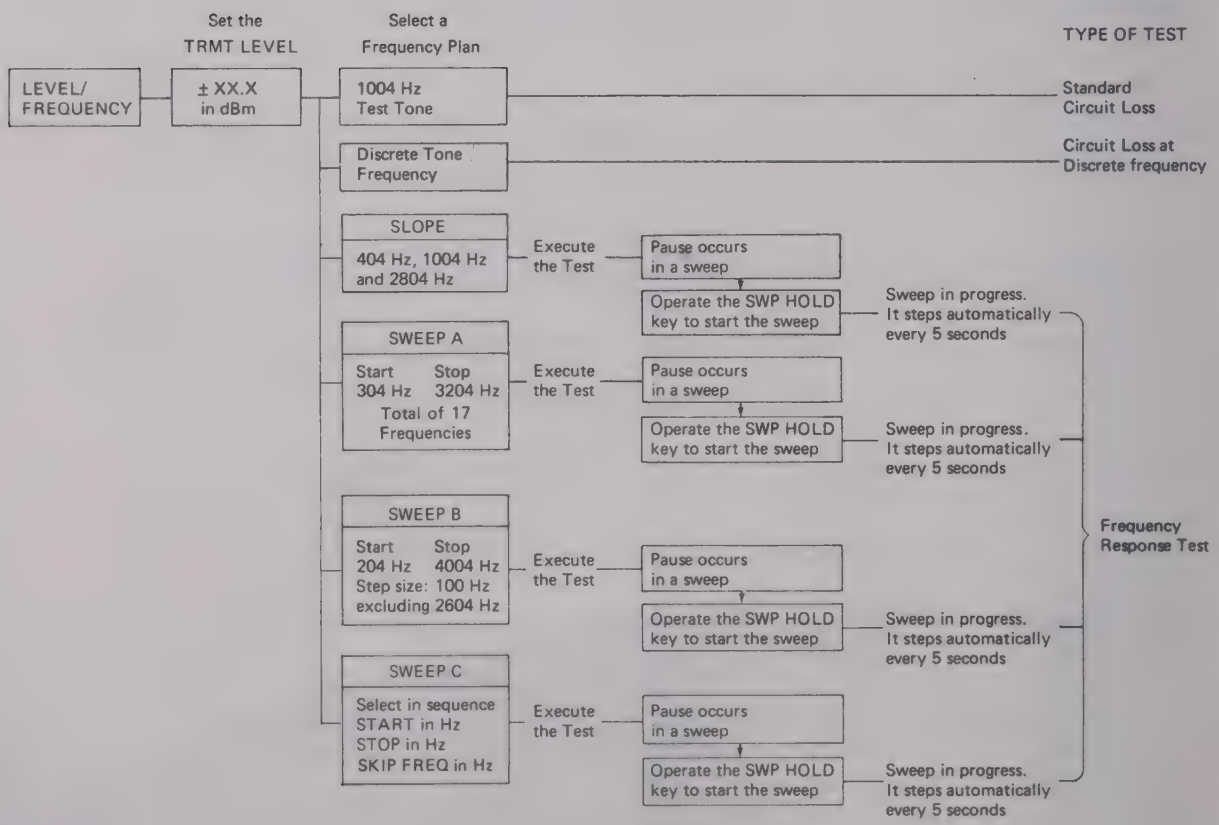

Set the TRMT LEVEL
Select a Frequency Plan
TYPE OF TEST
LEVEL/ FREQUENCY
± XX.X in dBm
1004 Hz Test Tone
Standard Circuit Loss
Discrete Tone Frequency
Circuit Loss at Discrete frequency
SLOPE
404 Hz, 1004 Hz and 2804 Hz
Execute the Test
Pause occurs in a sweep
Operate the SWP HOLD key to start the sweep
Sweep in progress. It steps automatically every 5 seconds
SWEEP A
Start 304 Hz Stop 3204 Hz
Total of 17 Frequencies
Execute the Test
Pause occurs in a sweep
Operate the SWP HOLD key to start the sweep
Sweep in progress. It steps automatically every 5 seconds
SWEEP B
Start 204 Hz Stop 4004 Hz
Step size: 100 Hz excluding 2604 Hz
Execute the Test
Pause occurs in a sweep
Operate the SWP HOLD key to start the sweep
Sweep in progress. It steps automatically every 5 seconds
SWEEP C
Select in sequence START in Hz STOP in Hz SKIP FREQ in Hz
Execute the Test
Pause occurs in a sweep
Operate the SWP HOLD key to start the sweep
Sweep in progress. It steps automatically every 5 seconds
Frequency Response Test

Figure 4-2. Selection Process for Level/Frequency Function

4.3.3 TEST MODE INSTRUCTIONS: To perform the test, press the EXECUTE key. When executing a test involving a sweep, depress the SWP HOLD key (after using the EXECUTE key) to start the sweep. To step the sweep forward one frequency, press the SWP HOLD key twice; to step the sweep backward one frequency, press the +/– key once.

The SWP HOLD key can be used to start/stop/step the sweep at any frequency in the sweep plan. When the sweep has been deactivated by the SWP HOLD key, pressing the key again will reactivate the sweep. When the sweep has been activated, pressing the SWP HOLD key will deactivate it. Two quick, successive depressions of the SWP HOLD key allow the sweep to forward-step to the next higher frequency within the sweep.

Either 1004 Hz or a discrete test tone is displayed for a Circuit Loss test. For a Frequency Response test, the signal level in dBm is displayed along with the corresponding signal frequency, thereby indicating attenuation variation with frequency.

The Level/Frequency function entry sequence is detailed in Figure 4-3.

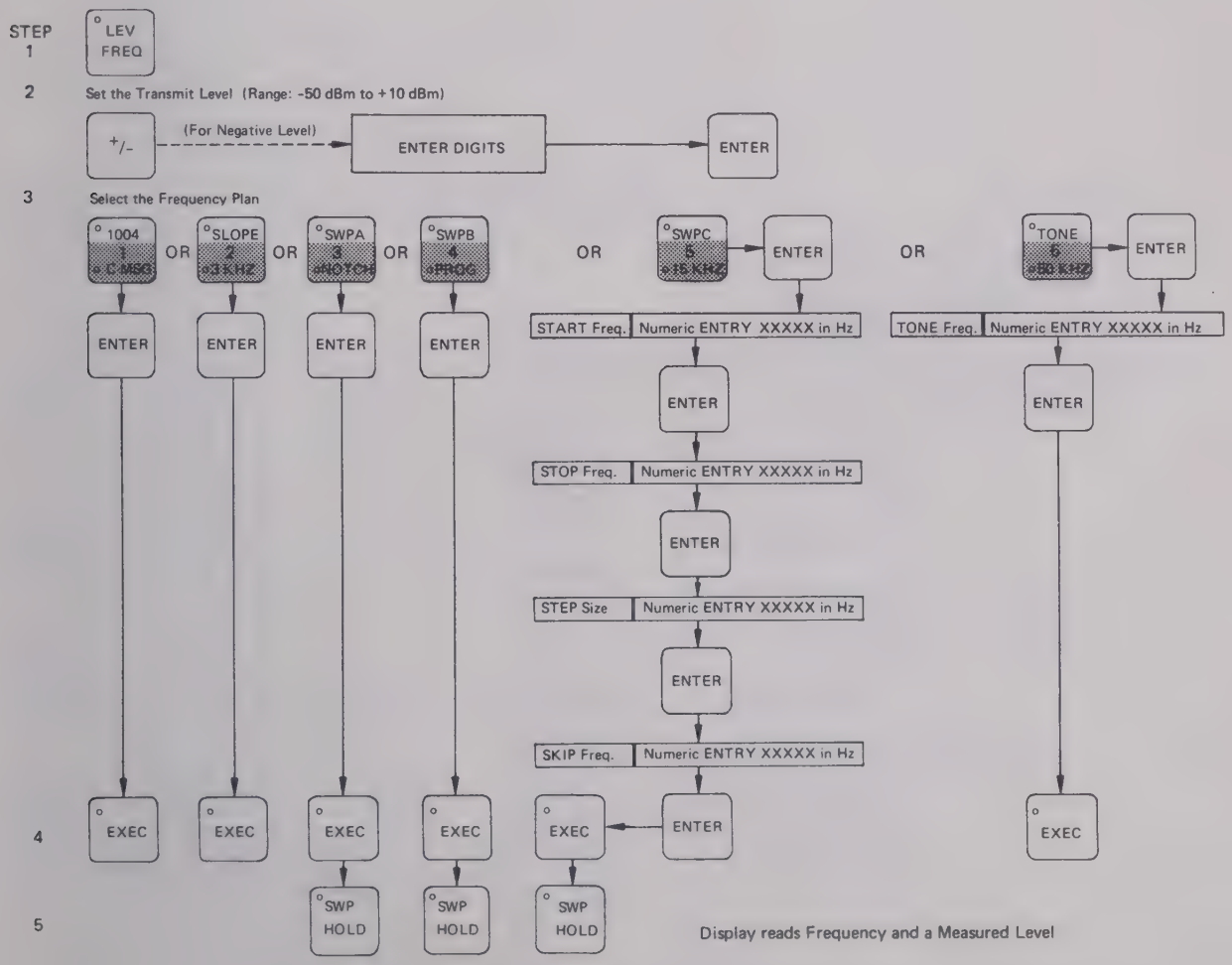


Figure 4-3. Level/Frequency Function Entry Sequence

4.5 NOISE: (Normal Mode)

The NOISE function key is used to measure circuit noise.

4.5.1 SET CONFIGURATION: The transmitter is not needed for this test, serving instead only as a quiet termination. The receiver comprises a selected weighting filter and a true RMS noise meter.

Noise can be measured with or without the NOTCH filter. To select the NOTCH filter and/or one of five different noise filters, follow the selection process shown in Figure 4-6.

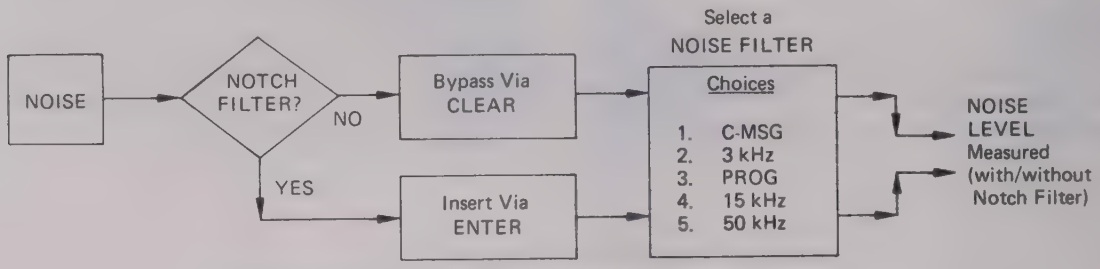


Figure 4-6. Selection Process for NOISE Function

4.5.2 TEST MODE INSTRUCTIONS:

To perform the test, press the EXECUTE key. The numeric display then shows the noise level in dBrn.

The noise function entry sequence is detailed in Figure 4-7.

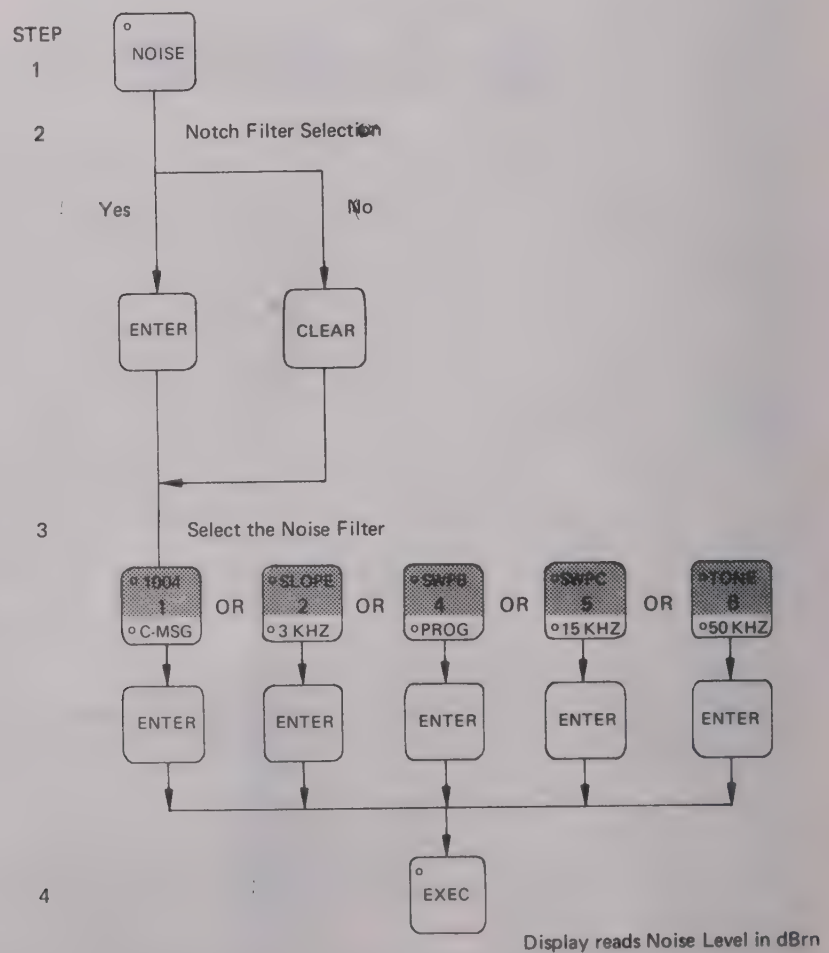


Figure 4-7. NOISE Function Entry Sequence

4.6 SIGNAL-TO-NOISE RATIO:

The S/N function key is used to obtain a direct reading of the Signal-to-Noise Ratio.

4.6.1 SET CONFIGURATION: The transmitter generates a 1004 Hz test tone, while the receiver is configured to act as both a level meter and a noise meter. The incoming tone level is measured to obtain the signal component; noise is measured by notching out the tone and using a noise weighting filter.

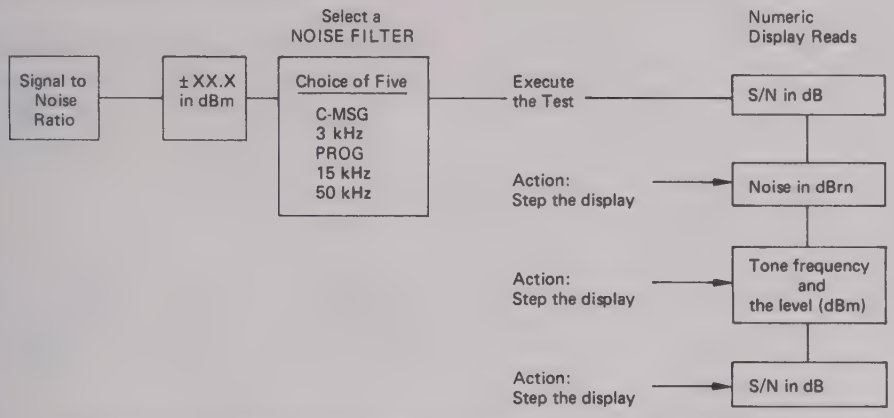


Figure 4-8. Selection Process for Signal-to-Noise Ratio Function

4.6.2 PARAMETER SELECTION:

The transmit level of the test tone and the noise weighting filter are selected. See Figure 4-8 for an illustration of the selection process.

4.6.3 TEST MODE INSTRUCTIONS:

To perform the test, depress the EXECUTE key; the signal-to-noise ratio is then displayed in dB. Notched noise is displayed (in dBrn) when the ADVANCE key is pressed. Pressing the ADVANCE key again causes tone level and frequency to be displayed. Pressing the ADVANCE key one more time causes the signal-to-noise ratio to be displayed again.

The S/N function entry sequence is detailed in Figure 4-9.

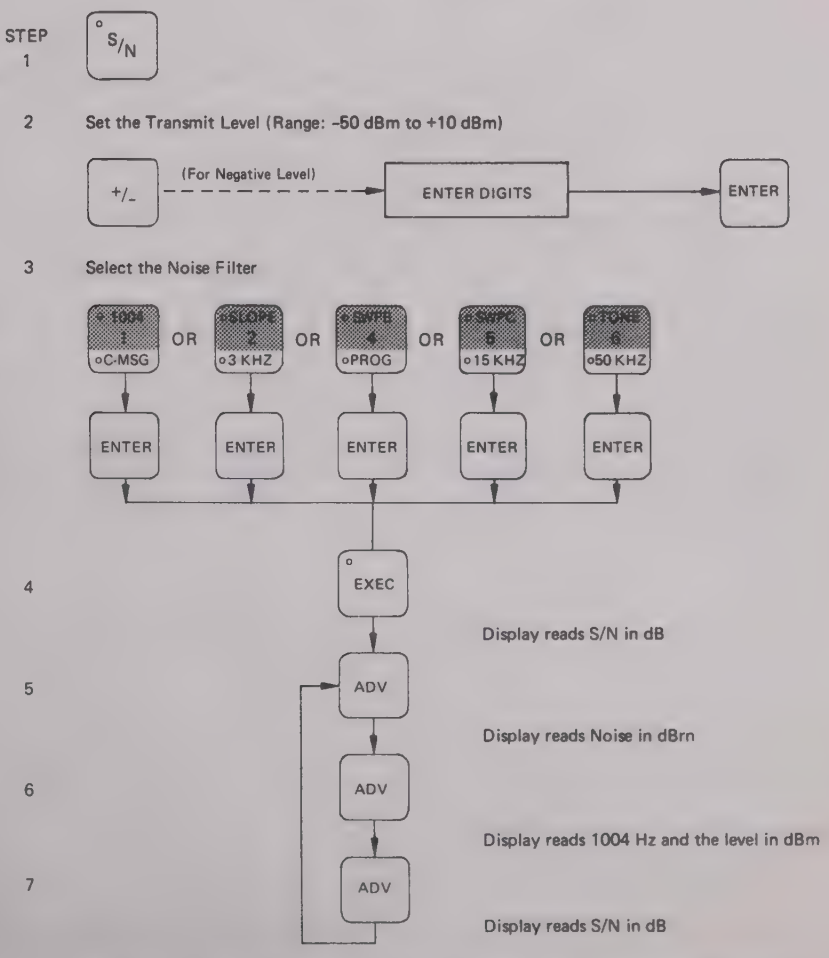


Figure 4-9. Signal-to-Noise Ratio Function Entry Sequence

4.7 NOISE-TO-GROUND: (Common Mode)

The N/G function key is used to measure the noise level when the line is unbalanced.

4.7.1 **SET CONFIGURATION**: The transmitter is not required and is used only as a quiet termination. The receiver unbalances the line to ground, routing the resultant signal through a selected weighting filter and a true RMS noise meter.

Five different noise filters are selectable (see Figure 4-10).

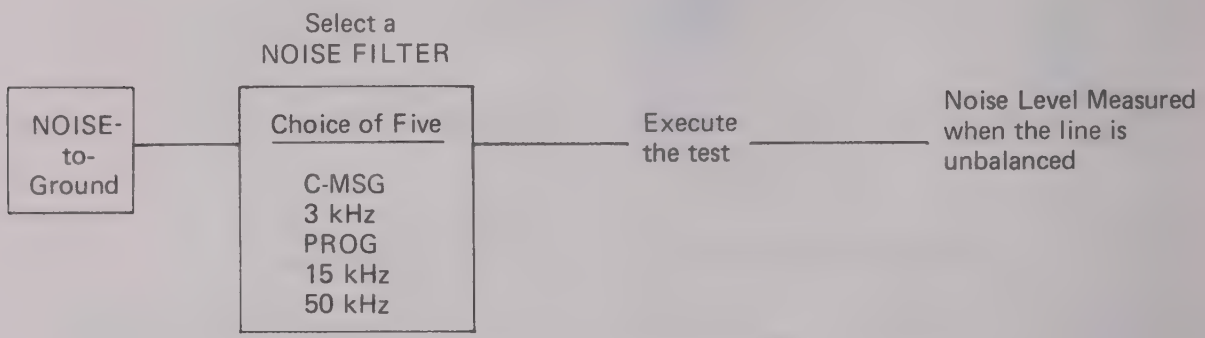


Figure 4-10. Selection Process for Noise-to-Ground Function

4.7.2 TEST MODE INSTRUCTIONS:

To perform the test, depress the EXECUTE key. The numeric display shows the noise level in dBrn.

See Figure 4-11 for the Noise-to-Ground function entry sequence.

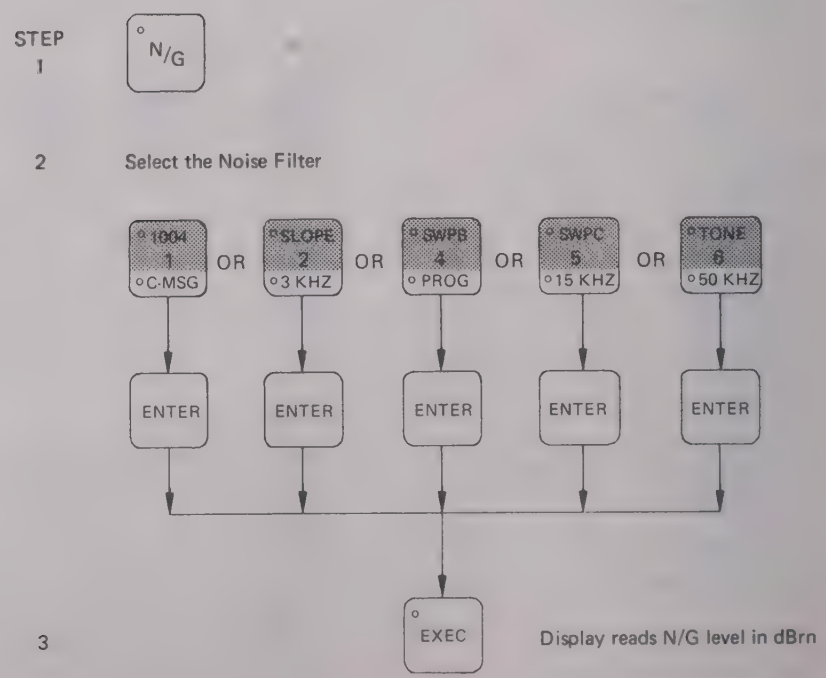


Figure 4-11. Noise-to-Ground Function Entry Sequence

4.8 IMPULSE NOISE:

The IMP NOISE function key measures impulse counts at three levels—Low, Mid, and High.

4.8.1 SET CONFIGURATION: The transmitter generates a 1004 Hz tone; the receiver circuits recognize impulse noise and maintain a count of impulses.

4.8.2 PARAMETER SELECTION: Notch filter, tone, transmit level, noise filter, threshold level, count rate, and count time are all selectable.

Figure 4-12 illustrates the selection process.

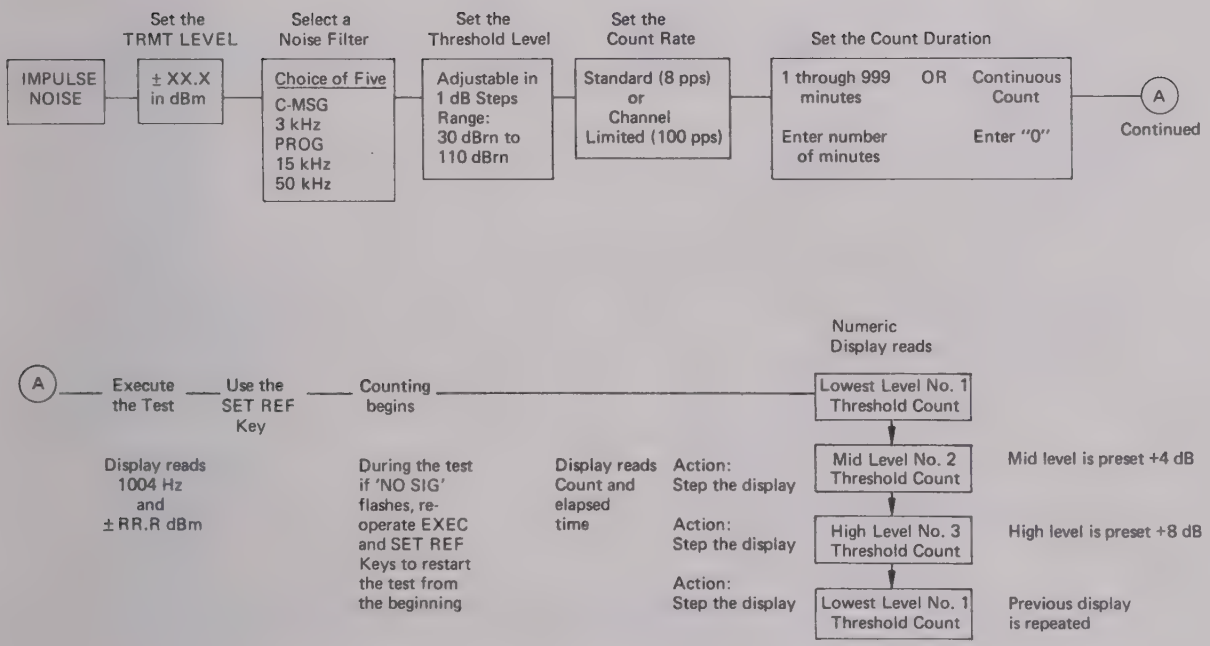

Set the TRMT LEVEL
Select a Noise Filter
Set the Threshold Level
Set the Count Rate
Set the Count Duration
IMPULSE NOISE
± XX.X in dBm
Choice of Five
C-MSG
3 kHz
PROG
15 kHz
50 kHz
Adjustable in 1 dB Steps Range: 30 dBrn to 110 dBrn
Standard (8 pps) or Channel Limited (100 pps)
1 through 999 minutes
OR
Continuous Count
Enter number of minutes
Enter "0"
A
Continued
A
Execute the Test
Use the SET REF Key
Counting begins
Numeric Display reads
Lowest Level No. 1 Threshold Count
Mid Level No. 2 Threshold Count
High Level No. 3 Threshold Count
Lowest Level No. 1 Threshold Count
Display reads 1004 Hz and ± RR.R dBm
During the test if 'NO SIG' flashes, re-operate EXEC and SET REF Keys to restart the test from the beginning
Display reads Count and elapsed time
Action: Step the display
Action: Step the display
Action: Step the display
Mid level is preset +4 dB
High level is preset +8 dB
Previous display is repeated

Figure 4-12. Selection Process for Impulse Noise Function

4.8.3 TEST MODE INSTRUCTIONS:

To perform the test, depress the EXECUTE key. Test duration is controlled by an elapsed-time clock, which starts running at the beginning of the test.

The left numeric display presents the clock time in minutes; the right numeric display shows the impulse noise level count. Further, the bar display indicates levels 1, 2, and 3 as the Low, Mid, and High levels, respectively. To step the display for reading other test results, press the ADVANCE key.

The Impulse Noise function sequence is detailed in Figure 4-13.

NOTE: If the received tone is less than –40 dBm, the test will not begin and the display will read "LO."

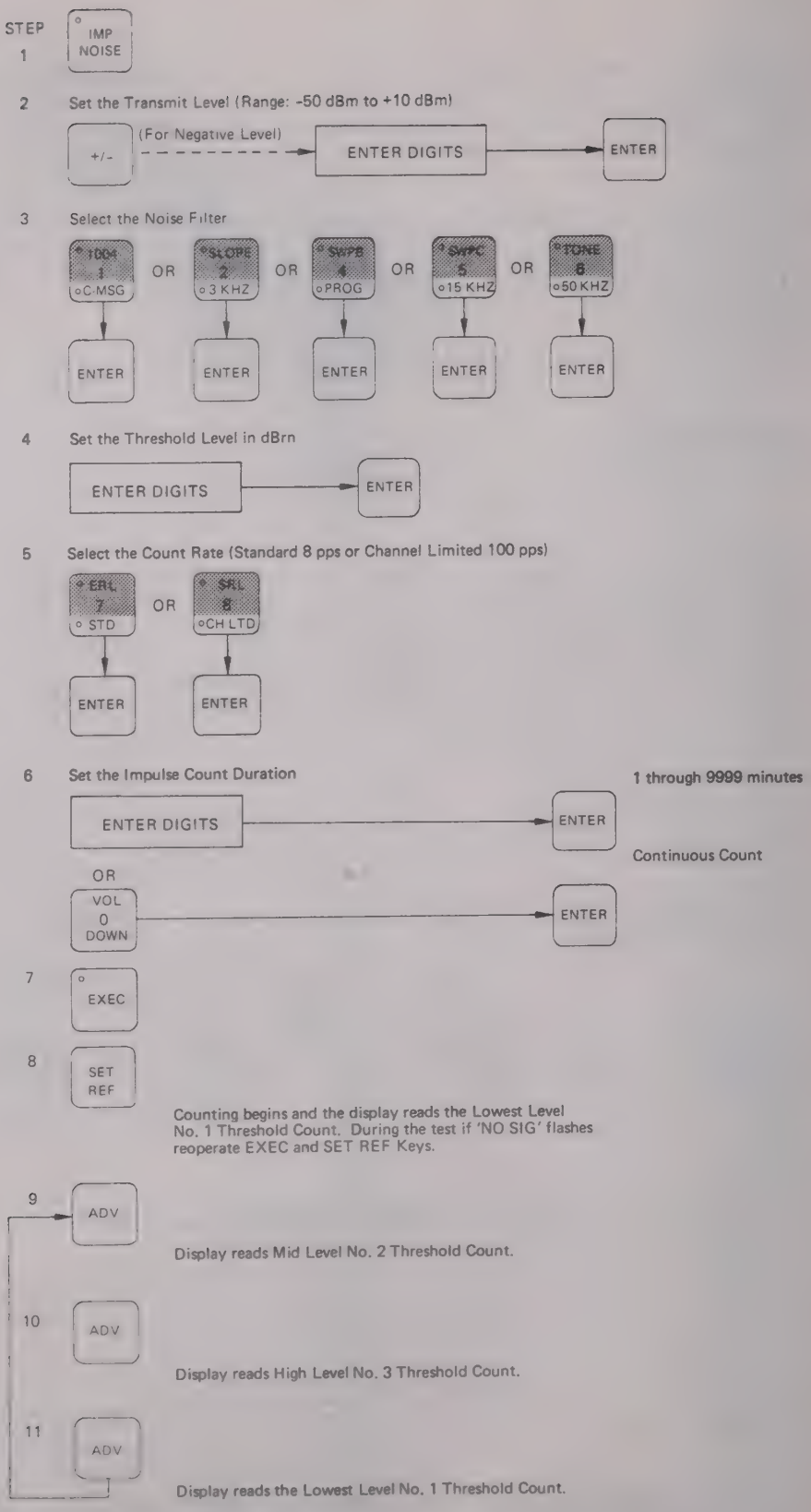


Figure 4-13. Impulse Noise Function Entry Sequence

4.9 PEAK-TO-AVERAGE RATIO (P/AR): (Optional)

4.9.1 SET CONFIGURATION: The transmitter generates a specially synthesized signal consisting of 16 non-harmonically related sine waves of known peak-to-average ratio. The receiver consists of circuits which measure signal dispersion in terms of reduced peak-to-average ratio. Envelope delay distortion, attenuation distortion, and noise are the primary factors affecting P/AR.

4.9.2 PARAMETER SELECTION: The transmit level of the output signal is the only selectable parameter. Maximum allowable value for the P/AR transmit signal is 0 dBm (Range: –40 dBm to 0 dBm).

The Peak-to-Average Ratio function entry sequence is detailed in Figure 4-14.

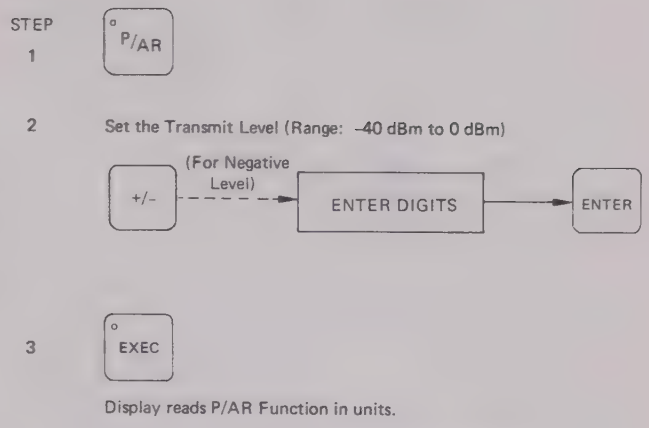


Figure 4-14. Peak-to-Average Ratio Function Entry Sequence

4.10 RETURN LOSS MEASUREMENT (FOUR-WIRE CIRCUIT): (Optional)

4.10.1 SET CONFIGURATION: The transmitter generates a shaped noise signal, while a test signal with a white noise band is limited by a selected weighting filter. Three transmit filters are available:

(1) Echo Return Loss (ERL)
560 Hz to 1965 Hz

(2) Singing Return Loss (SRL)
260 Hz to 500 Hz

(3) Singing Return Loss-High (SRL-HI)
2200 Hz to 3400 Hz

The receiver consists of a flat noise meter.

NOTE: If the 135-ohm or Bridging termination is used, a numbered error message is provided (see Table 7-2.).

4.10.2 PARAMETER SELECTION: The transmit level of the output signal, and the weighting filter, are both selectable.

See Figure 4-15 for the selection process and Figure 4-16 for the function entry sequence.

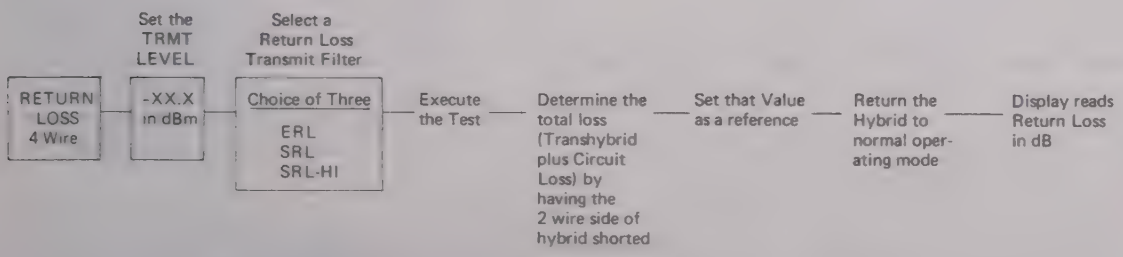

RETURN LOSS 4 Wire
Set the TRMT LEVEL
-XX.X in dBm
Select a Return Loss Transmit Filter
Choice of Three
ERL
SRL
SRL-HI
Execute the Test
Determine the total loss (Transhybrid plus Circuit Loss) by having the 2 wire side of hybrid shorted
Set that Value as a reference
Return the Hybrid to normal operating mode
Display reads Return Loss in dB

Figure 4-15. Selection Process for 4-Wire Return Loss Function

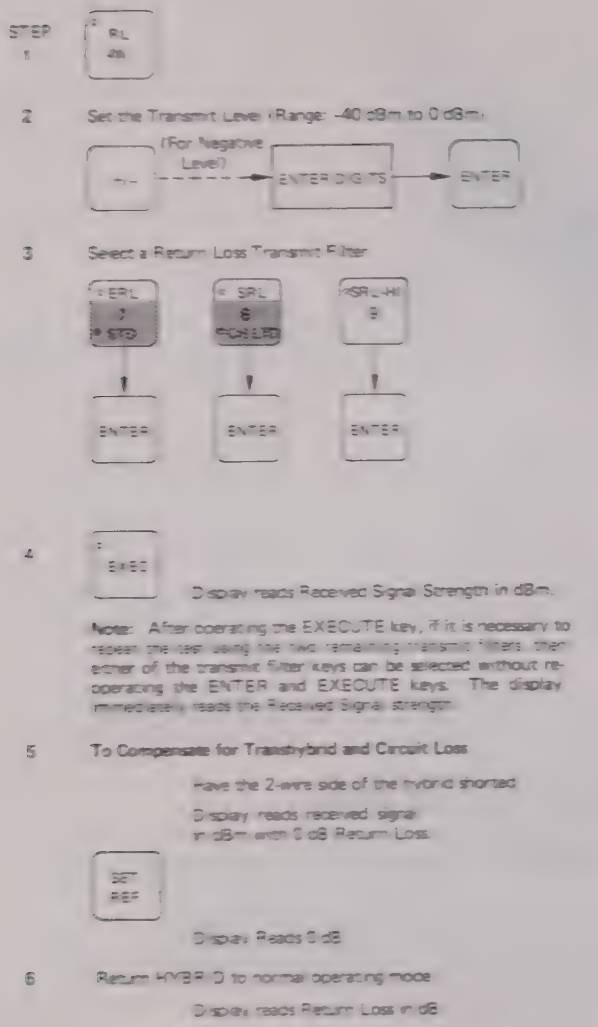

STEP
1
2
Set the Transmit Level (Range: -40 dBm to 0 dBm)
(For Negative Level)
ENTER DIGITS
ENTER
3
Select a Return Loss Transmit Filter
ERL
7
STD
SRL
8
SRL-HI
9
ENTER
ENTER
ENTER
4
EXEC
Display reads Received Signal Strength in dBm.
Note: After operating the EXECUTE key, if it is necessary to repeat the test using the two remaining transmit filters, then either of the transmit filter keys can be selected without re-operating the ENTER and EXECUTE keys. The display immediately reads the Received Signal strength.
5
To Compensate for Transhybrid and Circuit Loss
Have the 2-wire side of the hybrid shorted.
Display reads received signal in dBm with 0 dB Return Loss.
SET REF
Display Reads 0 dB
6
Return HYBRID to normal operating mode
Display reads Return Loss in dB

Figure 4-16. 4-Wire Return Loss Function Entry Sequence

4.10.3 TEST MODE INSTRUCTIONS: To perform the test, press the EXECUTE key. To make transhybrid loss (THL) the reference, zeroing the display, use the SET REF key.

4.11 RETURN LOSS MEASUREMENT (TWO-WIRE CIRCUIT): (Optional)

4.11.1 SET CONFIGURATION: The transmitter generates a shaped noise signal, while a test signal with a white noise band is limited by a selected weighting filter. Three transmit filters are available:

(1) Echo Return Loss (ERL)
560 Hz to 1965 Hz

(2) Singing Return Loss (SRL)
260 Hz to 500 Hz

(3) Singing Return Loss-High (SRL-HI)
2200 Hz to 3400 Hz

The receiver consists of a flat noise meter.

4.11.2 PARAMETER SELECTION: The transmit level of the output signal, and the transmit weighting filter, are both selectable.

See Figure 4-17 for the Two-Wire Return Loss function entry sequence.

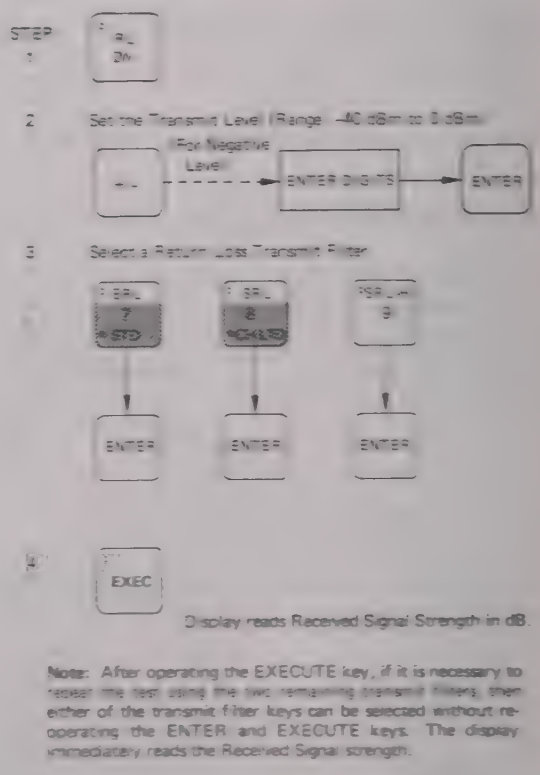


Figure 4-17. 2-Wire Return Loss Function Entry Sequence

4.11.3 TEST MODE INSTRUCTIONS: To perform the test, depress the EXECUTE key. The display shows return signal strength in dB.

SECTION 5

MAINTENANCE

5.1 RECEIVING INFORMATION

5.1.1 Inspect the test instrument carefully for possible shipping damage.

NOTE: It is suggested that the original shipping container and packaging materials be retained for instrument storage or for shipping.

Then verify the contents of the shipping container against the packing list.

5.1.2 If the instrument received is in damaged condition, immediately notify the carrier. If the order is incomplete, or the instrument fails to operate properly, contact the Sierra Customer Service Department at the following address:

Customer Service Department
Lear Siegler, Inc.
Sierra Electronic Division
3885 Bohannon Drive
Menlo Park, California 94025

Telephone: (415) 321-5374
TWX: 910-373-1282

5.2 REPAIR INFORMATION

5.2.1 Operator maintenance of the 812A is limited to line input voltage changes, fuse replacement, and cleaning. Calibration and maintenance should be performed at the Sierra factory, where specialized test equipment for the analysis of hardware/software malfunctions is available. Service and repair information may be obtained by contacting the Sierra Customer Service Department.

NOTE: If the instrument must be returned for repair, contact Sierra's Customer Service Department to obtain packing and shipping instructions, and a return authorization number.

5.3 TEST SET CLEANING

5.3.1 For normal cleaning of the 812A exterior, including the display face, use a damp cloth. Heavy grease spots can be removed using a cloth dampened with a mild detergent. Avoid getting excessive liquid on the cloth.

5.4 POWER REQUIREMENTS

5.4.1 The 812A operates from a 115/230 VAC, 60 Hz line source. Before operating the instrument, make sure that the voltage indicated on the plug-in card inside the power module (at the back of the test set) matches the line source, i.e., 115 or 230. To change the operating voltage, remove the plug-in card from the power module; then reinsert it, so that the proper designation is visible when the FUSE PULLER is in the normal position. If a voltage change is to be made, it will be necessary to change the fuse as well to the value shown in Table 5-1.

5.5 DISPLAY OF ERROR CODES

5.5.1 Errors will show up in the following cases:

(1) When a pushbutton is pressed while the set is running through the calibration and self-test process, an error code will be displayed.

(2) For the P/AR Function, either the 600 ohm or the 900 ohm termination must be selected; selection of the 135 ohm termination will cause an error display to be generated.

NOTE: The TERMINATE ■ (released) mode must be selected before the set runs through the calibration and self-test process.

(3) If part of the circuitry is out-of-tolerance (cf. Section 7, Appendix, Table 7-2 for Error Codes), an error display will be generated.

5.6 OPTIONAL BATTERY PACK

5.6.1 GENERAL: The optional nickel-cadmium battery pack requires no maintenance. If it is necessary to store a spare battery pack, be sure it is stored in a cool, dry place. The lower the storage temperature (20° C or lower), the longer the battery will retain its stored energy.

5.6.2 A fully-charged test set can be operated continuously for at least four (4) hours. When the battery voltage reaches 12V, discharge is terminated and the instrument shuts off.

5.6.3 When an instrument equipped with an optional battery pack frequently draws its power from an AC source, its battery pack will retain a full charge for a much longer time than would otherwise be the case. However, frequent use of an AC source will cause a temporary failure in the battery pack, i.e., the output voltage per cell will drop. This is a reversible condition which can be corrected by one or two full discharge/charge cycles.

5.6.4 BATTERY CHARGING: When the optional battery pack is installed, the 812A is also equipped with a built-in charger. To charge the battery pack, turn the POWER switch to OFF, and connect the instrument to an AC line source; the battery pack will be fully recharged in 14-16 hours.

5.6.5 BATTERY-IN-LINE FUSE: This is a normal blow 2A fuse, which can be reached by removing the bottom panel of the instrument. To replace the fuse, remove and retain the two screws from the bottom panel.

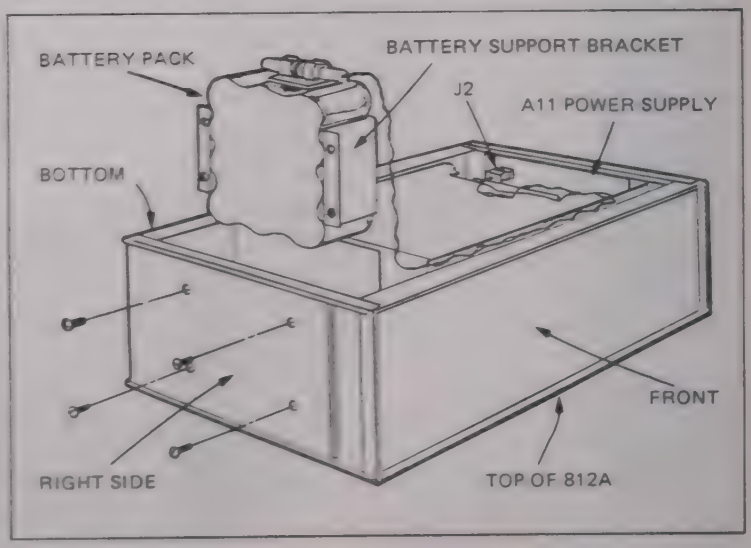
5.6.6 BATTERY PACK INSTALLATION PROCEDURES

1. Remove right side cover from Sierra 812A.
2. Turn Sierra 812A upside down and set it on its top.
3. Remove bottom cover from unit.
4. If unit already has battery, remove the battery support bracket by unscrewing the four screws that hold the bracket to the right side panel. Remove old battery pack.
5. Install battery pack in the bracket so that the leads are up, and with the fuse clips positioned as shown in figure 5-1.
6. Slide the battery pack and the bracket into position along the right side of the panel. Attach the bracket to the side panel with the screws, as shown.
7. Place the fuse holder (plastic-enclosed item in battery cable) in fuse clips, and run the battery harness along the front end of the unit. Plug the battery plug into jack J2 of the A11 power supply board, which is mounted on the left side panel.
8. Replace both bottom and side covers of the unit and return 812A to normal position.
9. Mark option label (located on back panel of 812A) with permanent type ink.
10. Charge the battery as instructed in paragraph 5.6.4.

Table 5-1. Field Replaceable Parts

Description	Sierra Part Number
Fuse, slow blow, 4/10A for 115 VAC	913200053
Fuse, slow blow, 2/10A for 230 VAC	913200055
Battery-in-line Fuse, normal blow 2A	913200058
Power Cord, detachable, 3-conductor	816400158
Rechargeable NiCad battery pack	918500026

Figure 5-1. Battery Installation



SECTION 6.

TECHNICAL DATA

6.1 SPECIFICATIONS

6.1.1 Table 6-1 lists the specifications for the 812A.

Table 6-1. Specifications

TRANSMITTER

Frequency	50 Hz to 85 kHz, selected by keypad: -1004 Hz test tone -SLOPE frequency plan -two VF sweep plans -programmable sweep -discrete frequency
Frequency resolution	1 Hz, <10 kHz 10 Hz, ≥10 kHz
Frequency accuracy	±.01%
Level	-50 dBm to +10 dBm 0 dBm max. < 200 Hz
Flatness	± 0.1 dB @1004 Hz (-19 dBm to 0 dBm) ± 0.2 dB 200 Hz to 15 kHz ± 0.5 dB <200 Hz and >15 kHz
Distortion	-50 dB, 150 Hz to 85 kHz (600 Ω, 900 Ω)
Sweep control	automatic with manual hold
Sweep rate	5 sec. per frequency

LEVEL/FREQUENCY MEASUREMENT

Frequency	50 Hz to 85 kHz
Level	-50 dBm to +10 dBm
Accuracy	± 0.1 dB @1004 Hz (-19 dBm to 0 dBm) ± 0.2 dB 200 Hz to 15 kHz ± 0.5 dB <200 Hz, >15 kHz
Relative level	60 dB range
Frequency resolution	1 Hz, <10 kHz 10 Hz, ≥10 kHz
Level resolution	0.1 dB
Level detector	averaging
Noise protection	low frequency noise rejection filter selected automatically

NOISE MEASUREMENT

Modes	-idle circuit noise -signal to noise, incl. noise with tone -noise to ground
Filter weighting	C-MSG, 3 kHz FLAT, PROGRAM, 15 kHz, 50 Kbit wideband
Range, metallic	10 dBrn to 90 dBrn
Range, to ground	50 dBrn to 130 dBrn
Range, S/N	10 dB to 50 dB
Notch filter	995 to 1025 Hz
Accuracy, metallic	1 dB
Accuracy, to ground	1.5 dB
Resolution	1 dB
Detector	RMS

IMPULSE NOISE MEASUREMENT

Threshold setting	adjustable in 1 dB steps, 30 dBrn to 102 dBrn
2nd level	-4 dB relative to setting
3rd level	-8 dB relative to setting
Filter weighting	same as NOISE, with notch
Count rate	8 pps or 100 pps
Count capacity	9999
Timer	1 min. steps to 9999 min. and continuous

PEAK-TO-AVERAGE RATIO (OPTIONAL)

Output level	-40 dBm to 0 dBm
Range	0 units to 120 units
Accuracy	± 2; 30 units to 110 units ± 4; < 30 units, >110 units
Resolution	1 unit

RETURN LOSS (OPTIONAL)

Output level	-40 dBm to 0 dBm
Modes	2-wire (FL) 4-wire (THL)
Test signals	broad-band noise, filtered as follows
—ERL	560 Hz to 1966 Hz
—SRL-LO	260 Hz to 500 Hz
—SRL-HI	2200 Hz to 3400 Hz
Range	0 dB to 50 dB
Accuracy	±0.5 dB, 0 dB to -40 dB
Resolution	0.1 dB
Balance network	600 Ω, 900 Ω, 2.16 µF 1% tolerance

GENERAL

Impedance	135 Ω, 600 Ω, and 900 Ω
Bridging impedance	50 k Ω, min.
Holding circuits	23 mA min., 1700 Ω, 46V 40 mA max., 400 Ω, 53V
Power requirements	115/230 VAC ±10%, 50/60 Hz approximately 30 watts
Battery pack (optional)	NiCad, 14.4V, 4 hr. capacity, charges in 14-16 hours.
Dimensions	7" x 13½" x 10½" (nominal)
Weight	22 lbs., incl. batteries

6.2 SWEEP PLANS

6.2.1 The four sweep plans available for LEVEL FREQUENCY and ATTENUATION DISTORTION tests are listed in Table 6-2 below.

Table 6-2. Sweep Plan Description

SWEEP PLAN	DESCRIPTION
SLOPE	404 Hz, 1004 Hz, and 2804 Hz
SWP A	Standard Sweep, 304 Hz to 3204 Hz as follows: 304, 504, 604, 804, 1004 (Ref.), 1204, 1404, 1604, 1804, 2004, 2204, 2404, 2504, 2704, 2804, 3004, 3204 Hz.
SWP B	204 Hz to 4004 Hz in 100 Hz steps (excluding 2604 Hz).
SWP C	Programmable Sweep: Choose start and stop frequencies, step size, and skip frequency.

SECTION 7

APPENDIX

7.1 DEFAULT VALUES

7.1.1 Default Parameter Values for each test function are stored in the instrument's nonvolatile memory. Table 7-1 lists these default values for each test function. The test set will display the default parameter value only when the instrument is powered up after being turned off for more than two weeks. Otherwise, a previously selected test parameter will be displayed.

Table 7-1. Default Values

FUNCTION	DEFAULT PARAMETER VALUE	
LEV/FREQ	Level	0.0 dBm
	Frequency	1004 Hz
ATTN DIST	Level	0.0 dBm
	Frequency	1004 Hz
NOISE	Filter	C MSG
S/N	Level	0.0 dBm
	Frequency	1004 Hz
	Filter	C MSG
N/G	Filter	C MSG
IMPL NOISE	Level	0.0 dBm
	Frequency	1004 Hz
	Filter	C MSG
	Count Rate	STANDARD (8 pps)
	Noise Level - Threshold (LOW)	59 dBm
	- MID/HIGH	+4 dB/+8 dB
	Duration	10 Min
P/AR	Level	0.0 dBm
RL 2W/4W	Level	0.0 dBm
	Filter	ERL

7.2 ERROR CODES FOR 812A

Error numbers are displayed during the calibration and self-test process.

7.2.1 Table 7-2 lists Error Codes for the 812A. Any two-digit message preceded with the letter "P" indicates a fatal set-operation condition; the unit should be removed from service. Consult Section 5 for the appropriate repair procedures.

Table 7-2. Error Codes for the 812A

ERROR	DESCRIPTION
E1	ROM 0 Checksum
E2	ROM 1 "
E3	ROM 2 "
E4	ROM 3 "
E5	ROM 4 "
E6	RAM Failure
E10	RMS detector DC error correction factor too high (>150 counts)
E11	AVE detector DC error correction factor too high (>150 counts)
E12	C Message Filter correction factor @ 0.0 dBm too high (>6 dB)
E13	Notch Filter " " " "
E14	RMS Detector " " " "
E15	Program Filter " " " "
E16	50 Kilobit Filter " " " "
E17	High gain stage " " " "
E18	Transmitter
E20	+10 dBm Fixed gain check bad (Transmitter and/or Receiver bad)
E21	+ 4 dBm " " " " "
E22	- 2 dBm " " " " "
E23	- 8 dBm " " " " "
E24	-14 dBm " " " " "
E25	-20 dBm " " " " "
E26	-26 dBm " " " " "
E27	-32 dBm " " " " "
E28	-38 dBm " " " " "
E29	-44 dBm " " " " "
E30	-50 dBm " " " " "
E40	1004 Hz @ 0.0 dBm Level Bad
E41	1004 Hz @ 0.0 dBm Frequency Bad
E42	50 Hz @ 0.0 dBm Level Bad
E43	50 Hz @ 0.0 dBm Frequency Bad
E44	85 kHz @ 0.0 dBm Level Bad
E45	85 kHz @ 0.0 dBm Frequency Bad
E50	P/AR Option Not Present
E51	P/AR Transmit Error
E52	P/AR Peak Detector Error
E53	P/AR Average Detector Error
E60	Return Loss Option Not Present
E61	Return Loss SRL (Low) Transmit Error
E62	Return Loss SRL-HI " "
E63	Return Loss ERL " "
E64	Improper termination for Return Loss Tests
PXX	Fatal ROM condition; remove unit from service

7.3 READOUT FOR THE SELECTED FUNCTIONS

Once a test function has been selected, and all procedures for that test have been completed, the LCD display will provide the information detailed in Table 7-3.

Table 7-3. Test Function Readouts

FUNCTION	LEFT DISPLAY FREQ/TIME	RIGHT DISPLAY LEVEL/COUNTS
Level/Frequency	NNNN Hz or NN.NN kHz	-NN.N dBm
Attenuation Distortion		
at reference frequency	1004 Hz	-NN.N dBm
at other frequency	NNNN Hz or NN.NN kHz	-NN.N dB
NOISE without tone	———	-NN dBrn
with tone	1004 Hz	-NN dBrn
Signal to Noise Ratio		
Signal to Noise Ratio expressed in dB Display can be stepped using the ADV Key	———	-NN dB
1. Notched Noise	———	-NN dBrn
2. Frequency and Level	1004 Hz	-NN.N dBm
Noise to Ground	———	-NN dBrn
Impulse Noise		
Various steps within a function		
1. When the transmit level is set	———	-NN.N dBm
2. When the Noise threshold is set	———	NN dBrn
3. When the count rate is selected	———	———
4. When the count duration is set	NNNN min.	———
5. Number of threshold counts (Level 1)	———	NNNN
6. Number of mid level counts (Level 2)	———	NNNN
7. Number of high level counts (Level 3)	———	NNNN
P/AR Function	———	NNN Units
Return Loss Function		
2 Wire / 4 Wire	———	-NN.N dB

WARRANTY

SIERRA ELECTRONIC DIVISION, LEAR SIEGLER, INC. warrants products manufactured by it to be free from defects in material and workmanship and to meet the applicable specifications under normal use and service for a period of 12 months from the date of original shipment by us. Our obligation under this warranty is limited to the repair or replacement of such products which, after having been returned to the factory or a point designated by us, shall be examined and in our sole opinion, found defective and that such defect was not induced by causes external to the product. Alternately, SIERRA may elect to issue credit for any such defective product. All products to be repaired or replaced shall be returned prepaid to the designated place of repair in accordance with authorization and packing and shipping instructions issued by SIERRA. Return shall not be made until such authorization and instructions are issued. Each returned product shall be accompanied by a statement or report fully stating the claimed defects and any other pertinent information concerning the failure.

SIERRA's responsibility under this warranty does not apply to any products which have been repaired, worked upon or altered by persons not authorized by us so as to in our sole judgement, injure the stability or reliability of such product, or which have been subject to misuse, negligence or accident, or where applicable, the serial number has been altered, effaced or removed. SIERRA shall not be liable for damages resulting from the use of the purchased product, nor shall SIERRA be responsible for any failure in the performance of other items to which the purchased product is connected or the functioning of an entire system or parts of any system of which the purchased product may be a part.

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LEAR SIEGLER, INC.
SIERRA ELECTRONIC DIVISION
3885 Bohannon Drive Menlo Park. CA 94025
Tel. (415) 321-5374 TWX 910-373-1282

www.manualsplus.com
1034018

LEAR SIEGLER, INC.
SIERRA ELECTRONIC DIVISION
3885 Bohannon Drive
Menlo Park, CA 94025
Tel (415) 321-5374
TWX 910-373-1282

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